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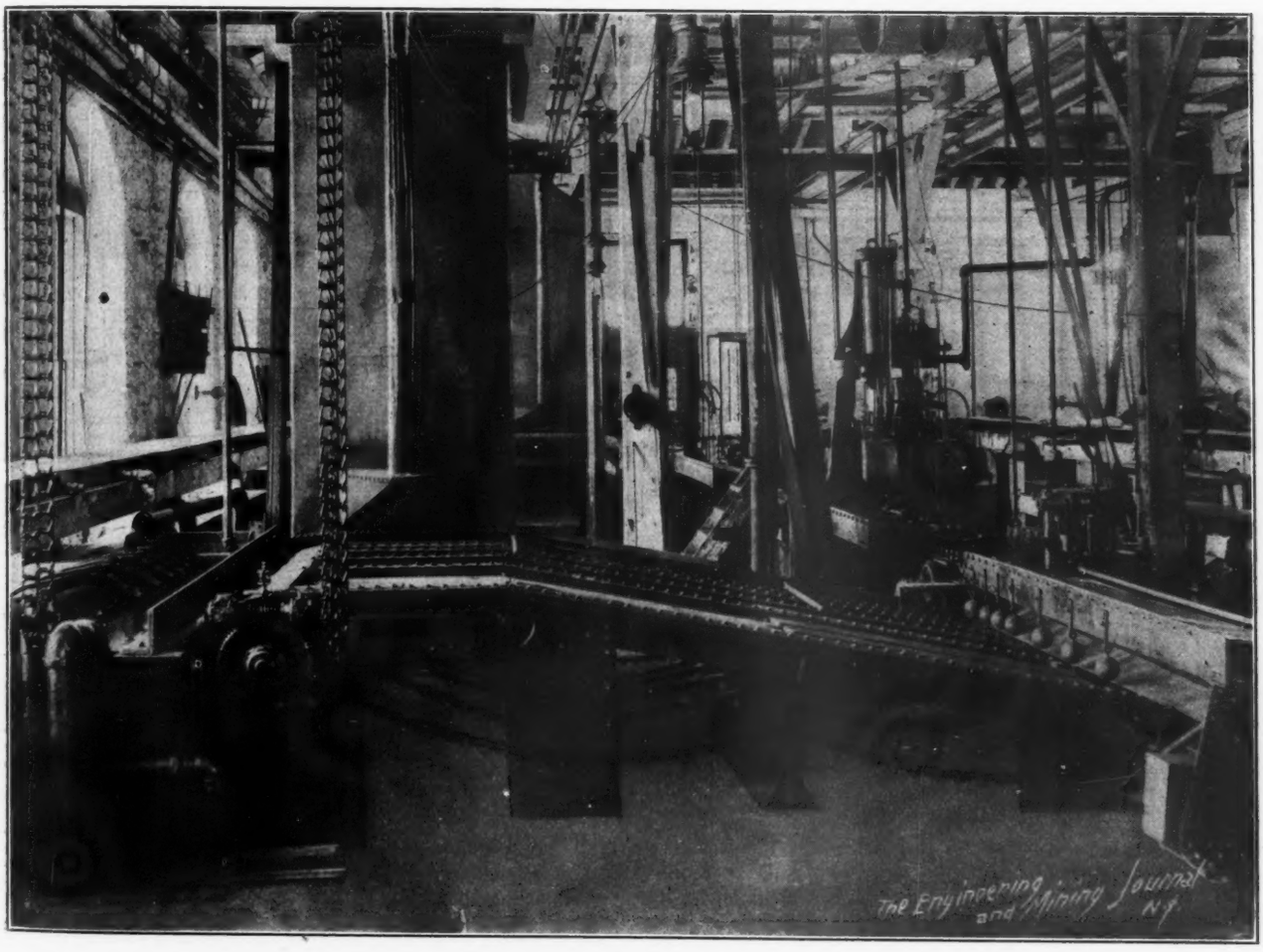
Calumet and Hecla Drill-Sharpening Device

A Machine That Sharpens 3640 Drills Daily, Capacity of Which May Be Doubled. Electrical Counter Records Number of Drills Handled

BY C. L. C. FICHTEL*

The Calumet & Hecla Mining Company operates about 300 drilling machines, which necessitates the sharpening of approximately 4000 drills per day. The economical and efficient handling of these drills was the problem that confronted M. M. Morrison, who has direct charge of all forgings and castings for the company, and it was through his efforts that the present system was worked out in detail. This installation is the most extensive and complete of any in the country and its operation is entirely satisfactory; sharpened drills are turned out in a manner equal if not superior in every respect to the old method of hand sharpening.



THE DRILL SHARPENING PLANT

Method of Handling

Owing to the location of the plant it was found impossible to afford railway facilities into the building; consequently it is necessary to haul the drills by team from the various shafts. As the drills come from underground they are assorted according to lengths and placed in an iron box, or case, built especially for this purpose. Upon their arrival at the shop an electric crane lifts the case off the conveyance and places it in its allotted space beside the belt conveyer, shown in the accompanying plan.

Each party of miners is held accountable for a certain number of drills, or an equivalent weight of steel; therefore it is necessary that each drill be returned to its original place. To accomplish this, each shaft is taken separately and a record made of the number and sizes of the drills as they are taken from the carrying case; when this number has passed through the machine and been restored to its place the next shaft is taken up.

Method of Sharpening and Finishing

As the drills are taken from their various cases they are placed upon a belt conveyer, which runs the full length of the

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building and travels at the rate of from 6 to 12 ft. per min., according to the rate of sharpening, the bit end of the drill facing the direction of motion. When the drill reaches the heating forge it is taken by hand from the belt and placed upon a chain conveyer, which carries it with a rotating motion through the heating forge, requiring about 3 min. to pass the heating portion. This forge is fed by crude oil under pressure and is heated to about 2000 deg. F. The drill leaving this conveyer falls onto a movable apron which, when lifted, allows the drill to slide into position in the sharpener.

Sharpener

The sharpening machine reduces the end of the bit to a cutting edge and shifts the surplus metal from the center to the edges. It is operated by compressed air at 65 lb. pressure, and consists primarily of a 5-lb. hammer in the form of a double die, striking 1600 blows per min. on a 4-in. stroke. When the drill falls into position from the heating forge it is clamped and held by the action of an air cylinder; this cylinder is operated by a foot lever, which also controls the throttle valve of the hammer.

The hammer mechanism is mounted on a sliding carriage controlled by a hand lever; this allows the device to work the metal from the heel of the bit to the edges and treats the opposite faces practically simultaneously. Upon the arrival of another drill from the forge the preceding one is released, and the lifting of the apron to allow the heated drill to come into the machine also causes the sharpened drill to fall upon a chain conveyer, which runs underneath this apron, and upon which it is carried to the next machine, the upsetter.

Upsetter

The functions of the upsetter are to restore the diameter of the drill and to back the cutting edges into a plane at right angles to the horizontal axis of the drill. This is accomplished by a few blows from an air cylinder, the piston of which carries the die. This cylinder strikes approximately 100 blows per min. on a 5-in. stroke, acting directly on the face of the drill. During this process the opposite end of the drill butts up against a rest and is securely held in position by a hand lever which grips it against stationary arms.

There are three of these rests, which necessarily must be adjustable to accommodate the various lengths of drill. They are staggered 120 deg. apart along an extended piston of a hydraulic cylinder; in this manner three different positions are obtained with an adjustment in each case of nearly 24 in., the length of the cylinder. This cylinder is operated by oil under about 65 lb. pressure, the pressure in the oil tanks being maintained by a retaining pump.

Fluter

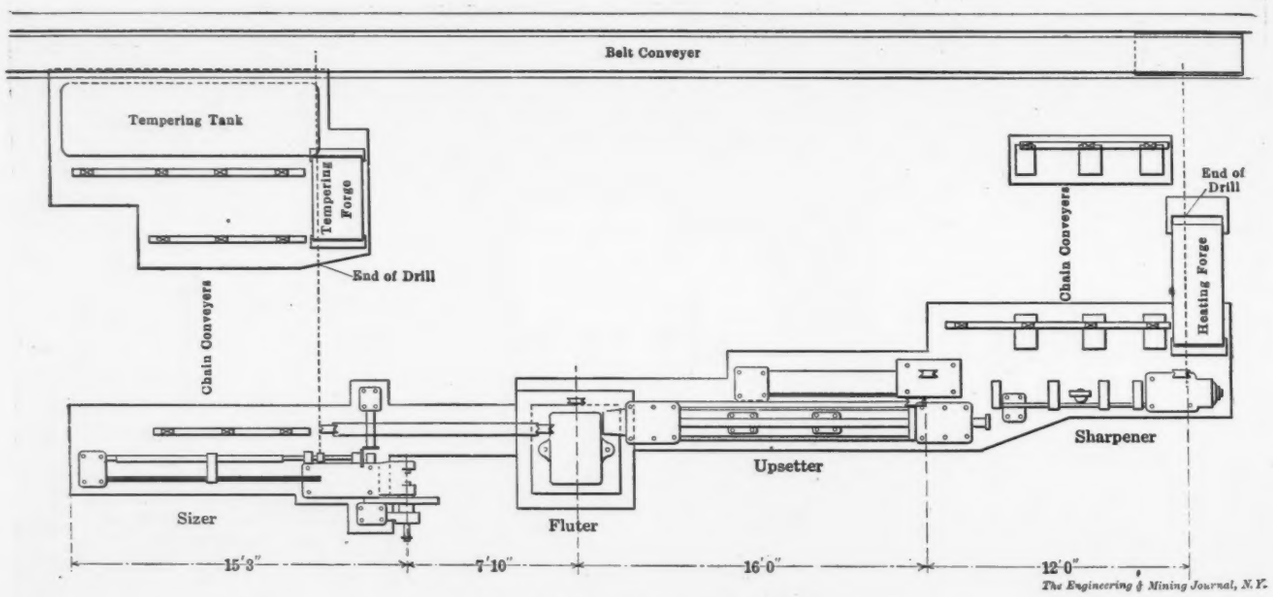
The drill next passes on to a fluter, which is an 800-lb. steam drop hammer, with a stationary die attached, acting upon a movable die. This straightens the vanes of the drill and reduces them to standard thicknesses. Two blows of the hammer are sufficient to accomplish this. The drill is then carried, in a manner similar to the connection between the sharpener and the upsetting machine, to the sizing machine.

Sizer

The sizing machine measures and reduces the drill to proper proportions, the diameter of a finished drill being commensurate to its length; that is, the greater the length the smaller the cross-section of the sharpened end. The drill entering this machine is forced into position by a movable rest, acting upon the machine end. The rest travels on a slide and is controlled by means of a screw; this is actuated by friction cones belted to the driving shaft. The action of this screw through a worm gear also controls the opening between the dies, a travel of 1 ft. on the screw changing the opening ⅛ in. When the drill has been placed in position, the clutch connecting the ram with the main shaft is thrown in and one complete revolution is made, forcing the dies together and reducing the ends of the drill accordingly. The drill is then turned half way and the two adjacent faces are treated in like manner.

The drill is now carried transversely on endless chains through the tempering forge. In passing from the sizer to the forge the heated end of the drill passes through a hood about 4 ft. long, through which an air jet from a Sturtevant fan blows, cooling the drill below 600 deg. F. before it enters the tempering forge. This reduction in temperature is made so that when the drill passes through the forge it will not be heated beyond the required depth from the sharpened edge. This forge is a duplicate of the heating forge, with the exception that it is narrower, the drill taking about 2 min. in passing through it. As the drills leave the forge they drop into a tank containing cold water; here they are hardened and then are elevated by a chain conveyer to the under side of the conveyer belt on which they are returned to their respective places.

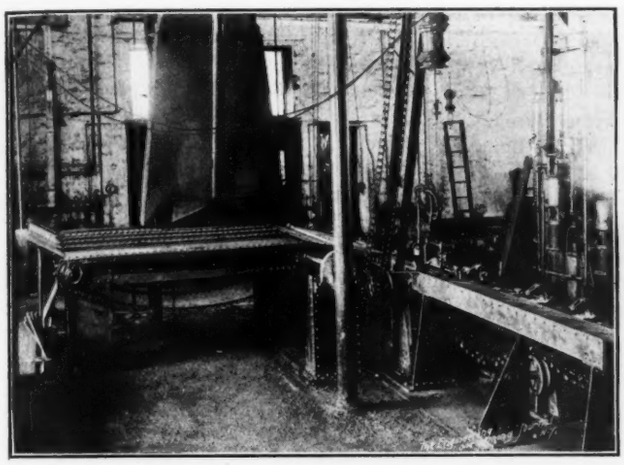
The number of drills passing through the machine are recorded by an electrically actuated counter, which operates as follows: When the drill passes a certain



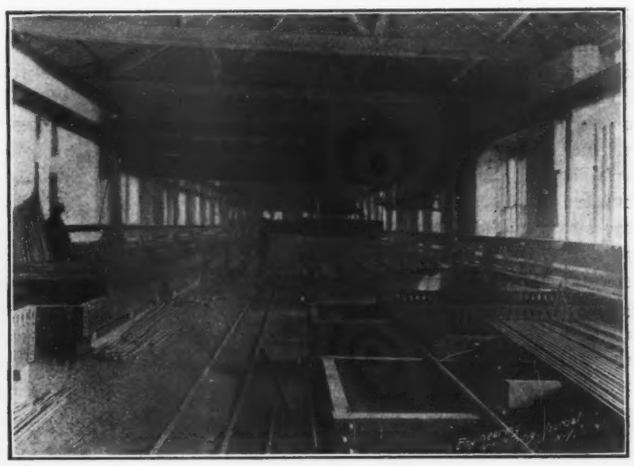
PLAN OF DRILL SHARPENING PLANT

point on its way to the heating forge it closes a contact, which operates a relay. The closing of this relay operates the alternating-current magnet coils, the armature of which is connected by a shaft to the arm of a reciprocating engine counter, and its pull lifts the arm against the tension of a spring. The alternating-current side of the apparatus consists of the reactive coil, a pair of magnet coils complete with armature and dashpot of a multiple-arc lamp, and is connected to the lighting circuit. The relay connection is made to avoid the grounding of the circuit on each stroke.

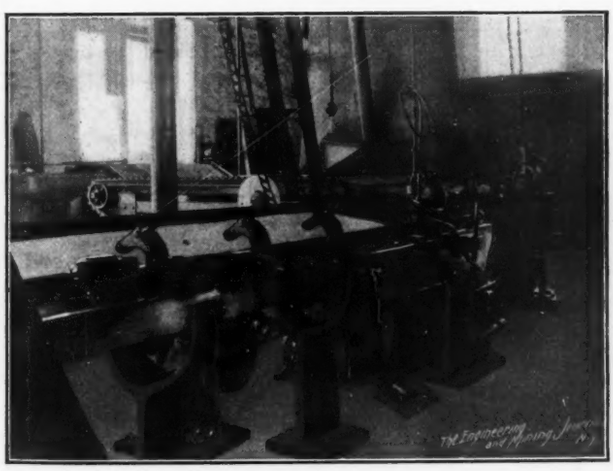
The compressed air used in the plant is furnished from the large central compressing plant. The shafting, conveyers, etc., are run by a 50-h.p. 2300-volt induction motor belted to the main drive. The installation includes two complete outfits as described and is treating at present 3640 drills daily, an average of three per minute per outfit. This can be increased to six per minute per machine if occasion demands. Considering 150 drills per day for a sharpener and helper as a good average by the hand method, it will be seen that a great saving is being effected.



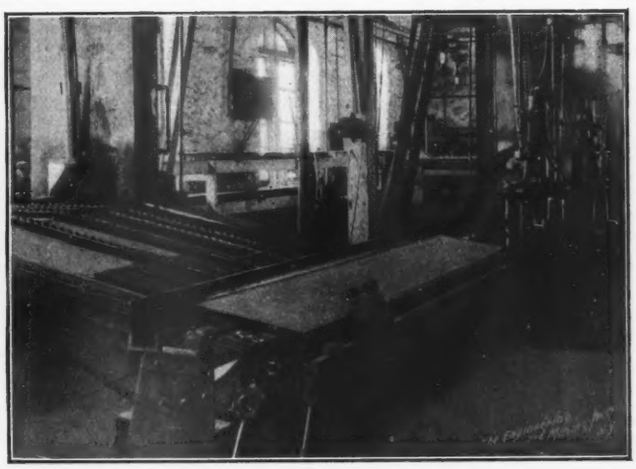
HEATING FORGE, SHARPENER, UPSETTER AND WESTINGHOUSE AIR PUMP



DRILL CASES AND ARRANGEMENT FOR HANDLING



UPSETTER, SHARPENER AND HEATING FORGE



TEMPERING FORGE, SIZER AND FLUTER

Magnesite in India

In a paper on the Indian magnesite industry, read before the Society of Chemical Industry, H. H. Dains describes the work carried on at the principal deposits lying in the Chalk hills, near Salem, in the Madras presidency. The magnesite covers a superficial area of about 2000 acres and occurs in numerous irregular veins which ramify an ultrabasic intrusion of eruptive rock called dunite, a mineral consisting essentially of magnesium orthosilicate. Generally the magnesite is nearly white; it has a specific gravity of 3, and a hardness of about 5. Shipments of the mineral recently made show from 96 to 97 per cent. magnesium carbonate, with an exceptionally low content of lime, silica, alumina and oxide of iron. A modern calcining plant for the production of caustic and "dead-burned" magnesia has been erected near the quarries. The material ultimately finds employment in the manufacture of refractory bricks for basic furnaces, artificial stone, flooring, fireproof partitions, and many other stoneware productions.

The town of Vallecas, Spain, according to *Stone*, May, 1909, is built almost entirely of meerschaum. Vallecas has on its outskirts great quarries of meerschaum too coarse for pipe making, and a meerschaum-built town is the result. In Morocco meerschaum is so plentiful that they use it, when soft and fresh, for soap. It gives a plentiful and cleansing lather. Ekdischehr, in Asia Minor, supplies the world's meerschaum. There are 2000 mines, large and small, and 8000 Kurd and Persian meerschaum miners work day and night in them. This meerschaum comes from the earth yellow and turns white after 10 days' bleaching in the sun.

Suction Gas and Its Application to Mining

Prejudice against This Type of Power Generator Is Being Overcome. Test of Plant Installed at Threlkeld Mines, Cumberland, England

BY GEORGE D. STEPHEN*

In no branch of applied science has the introduction of suction gas met with greater success than in modern mining practice. Mining men generally are somewhat prejudiced against power gas on account of its unreliability. In spite of this its popularity increases day by day, chiefly owing to its cheapness and efficiency. As regards reliability, there is no doubt that for small sizes, suction-gas engines and producers compare favorably with steam engines; for large sizes the balance of favor in this respect lies with the steam engine. This will be more apparent when the starting of large suction engines is discussed. For mining and quarrying purposes, suction-gas plants made by both English and Continental makers are to be found in almost every country in the world, performing different classes of work.

Installation in Cumberland, England

The gas plant at Threlkeld mines, Cumberland, England, was built by Crossley Brothers. It consists of two generators and engines. Gas pipes are 10-in. diameter, fitted with stop valves so that one or both engines may work off either generator and convey the gas a distance of 20 to 30 ft. to the engines.

The engines, 100 h.p., are each directly coupled by a flexible coupling to 60-kw. direct-current generating sets, running at 200 r.p.m. in parallel, and supplying the same mains. The starting arrangement consists of a small pump by which petrol vapor is pumped into the engine cylinder and subsequently ignited. Scotch anthracite in the form of peas ½ to 1 in., is used in the producer. The coal is fed into the producer by means of a storage hopper and feeder, from which it reaches the working level of the fire by gravitation; this arrangement causes the incandescent part of the fire to be constantly fed with warm dry fuel. The feeder and hopper are so designed that the fuel can be introduced into the furnace without at the same time introducing air.

The Producer

The producer, similar to the one shown in the accompanying illustration, consists of a cylindrical metal shell, with angle-iron stays and is lined on the inside with firebrick separated from the outside metal skin by a coating of sand. The firebrick lining rests on a metal ring supported on two cast-iron boxes, termed superheaters, placed at the hottest part of the fire and mounted on a flat plate carried right across the producer. The fire bars rest in a hole in the center of this plate. In this way a pit is formed immediately below the grate, and in this pit the steam and air used in gas making mix before passing together through the fire. The life of the firebrick lining depends upon the quality of the brick, but may be taken at about six or nine months. Around the cylindrical bell, defining the depth of the fuel in the producer, is the saturator or boiler *B*. In the bottom of the saturator, warm water is kept at a definite level by means of an overflow pipe *P*. The saturator takes the form of a flat dish extending to the outer shell of the generator, and has a series of baffle plates on its under surface which form passages, through which the hot gases pass, giving up heat to the water on their way to the scrubbers. This is the application of the principle of regeneration and accounts for the great economy effected, for it is clear that the requisite steam is raised in the saturator by extracting the heat from the gas as it passes from the fire to the coke scrubbers.

Course of the Air

The air is admitted through what are known as the primary and secondary supplies. The primary air, which consists of air only, is admitted direct to the closed space under the fire grate by way of the starting fan. The secondary air, drawn through the air regulator, passes over the surface of the water in the saturator, absorbs water vapor, passes by way of vertical pipes (marked steam pipe in figure) embedded in the packing of the furnace, thence passing through superheaters to the closed chamber under the fire grate, where it is mixed with the primary air from the fan inlet before entering the fire. The gas is led off by a pipe *E* to the scrubbers, where it is cooled and washed before being used in the engine. A dust collector is sometimes interposed between the producer and the scrubbers, a pipe from the bottom of the collector carrying dust from the gas pipe into the water of the seal box *F*. A blowoff cock is fitted through which the inferior gas passes when starting up the generator.

The seal box also acts as a safety device, for, if an explosion were to take place, the water seal would blow out.

Scrubbers

The scrubbers consist of cylindrical vessels of wrought iron filled with coke, each provided on the top with a water spray; the water trickles through the coke, cools the gas, and increases its density and capacity for doing work. Two scrubbers are attached to each generator, for if the gas is not sufficiently cooled, water vapor is carried over into the gas mains, which usually gives a damp sparking plug. A sawdust scrubber is sometimes provided to remove any trace of tar from the gas, tar being objectionable for the continuous running of gas engines, as it clogs the valves and causes undue stoppage for cleaning.

Working on Light Loads

One difficulty experienced when working on a light load is that the reduced number of strokes made with the gas valve open may not draw enough air to keep the fire in active condition so that full load may be thrown on at any time. To overcome this difficulty a bypass is fitted between the gas pipe and the mixing chamber so that during each suction stroke of the engine a small quantity of gas passes into the mixing chamber and a small quantity of air is drawn through the producer fire. This quantity of gas is not sufficient to form an explosive mixture and so the exhaust from the engine contains a small percentage of gas. This bypass is a very convenient arrangement, but for ordinary conditions prevailing at a mine, experience has shown that the coal consumption is considerably greater and in a few cases the device has been discarded. At the Threlkeld mine the suction-gas plant runs on a light load during the night, pumping water from a shaft and no difficulty is found in maintaining the quality of the gas when no bypass is fitted.

On a light load another difficulty must be overcome. When the governor cuts out a number of charges, steam continues to be generated which fills the steam space and causes the charge to be exceedingly inflammable. The fire is cooled by the production of this charge, and when the temporary richness has passed off, the gas produced at a lower temperature is of a poorer quality. In the Threlkeld plant this difficulty is surmounted by allowing

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the steam to escape at light loads through one or more cocks opening from the air-space in the saturator into the open air.

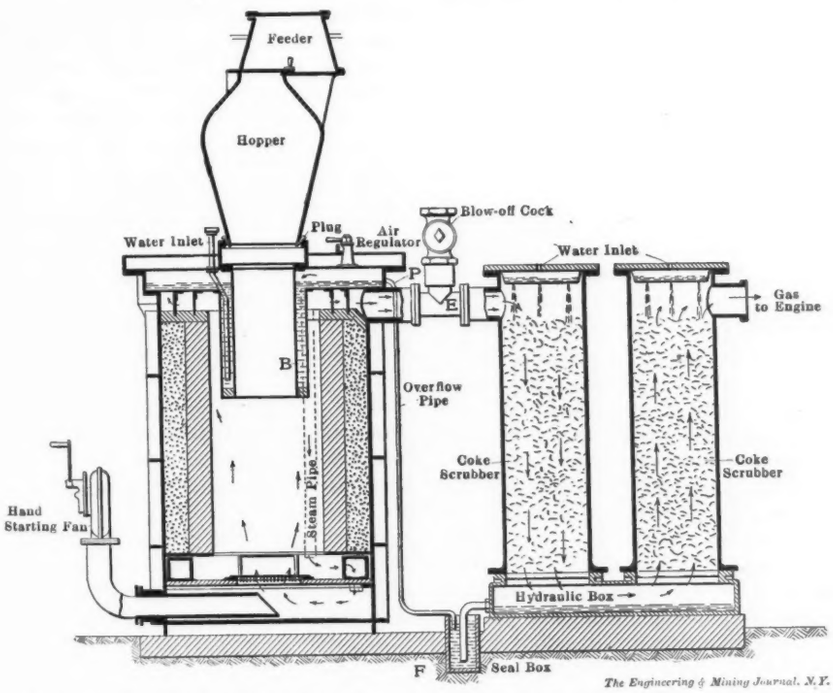
Starting the Plant

After the fire is lighted, air is forced underneath the grate by means of a fan, worked by hand or a small motor; this air escapes through the blowoff valve. Blowing is continued for 15 or 20 minutes when the blowoff valve is closed and the gas tested at the engine test cocks; if it maintains itself alight, giving a long blue flame, it is of good quality for use in the cylinders. With a small engine a turn or two at the flywheel is usually sufficient to start it, but with larger sizes some other means must be adopted, such as the use of compressed air, petrol, etc.

At the Threlkeld mine some difficulty has been found in starting the engines. As no compressed air is available, petrol vapor is pumped into the engine cylinder and ignited. This gives the engine a "kick off;" the gas is turned on at the engine and if the sparking arrangement is in good order, the engine invariably starts. Moisture in the gas pipes is a source of annoyance, as it destroys the regularity of the sparking, and it has been found advisable to adopt a high-tension pump spark for starting and, when well started, to use the magneto.

When working two engines off one generator the difficulty of starting the engine farther away from the producer is increased. The gas has to be shut off from one of the engines before the other can be started, and if the former is heavily loaded it soon slows down.

As far as can be seen, it appears that the engine to be started must attain a certain piston speed before it can draw gas from the generator and this speed cannot be obtained by petrol, but by compressed air only, which is costly to obtain unless already in use at the mine. The management has, however, adopted a rather novel method of starting, by converting one of the d.c. dynamos into a motor until the required speed is obtained, when it is again converted into a generator. As the two compound-wound machines have to run in parallel and supply the same mains, a number of switches are required, which method introduces complications difficult to understand by unskilled labor and in this respect is disadvantageous. One point in favor of this method is that any defect in the sparking or in the working of the engine can be easily detetcted, while the engine is running without any gas.



PRODUCER PLANT SIMILAR TO THE ONE INSTALLED AT THRELKELD MINES, CUMBERLAND

Fuel Consumption

The guarantee made by most makers is, that under ordinary working conditions the full consumption, using anthracite coal, shall be under 1 lb. per b.h.p.-hour. Compared with a steam plant the cost of attending to a suction plant is small, as the generator is charged only every four hours; the time required to clear the fire and recharge occupies only five minutes. The "stand-by" loss for a suction plant is very much less than for a steam plant and for generation of electricity full load can be put on in a few minutes from a "stand-by" generator.

Perhaps the perfection of electrical winding will be a stepping stone to the extensive application of electricity and the general disuse of steam power. And it is by the introduction of suction gas or some form of power gas for the production of electricity that collieries and metal mines will benefit. Suction-gas plants seem to be well adapted for the development of metal mines in inaccessible districts, where water power is unavailable, and where the transport of a large supply of coal, such as is required by steam engines, is the determining factor between success and failure.

Test Plant at Threlkeld Mine

The object of the test was to determine the coal consumption under the varying working loads, due to winding and pumping by electricity. The installation had been in commission almost a year at the time of the test.

After the klinkers were removed, the producer was filled up to the level of the hopper and at the end of the trial the klinkers were again removed and coal filled in to the predetermined level, so that complete accuracy was insured in measuring the fuel. The coal was weighed by a spring balance which was previously checked by standard weights. The gas engine was directly coupled by a flexible coupling to a d.c. 6-pole compound-wound dynamo of 60 kw. capacity at 200 revolutions per minute.

Following is a summary of the test:

Duration of test, 4 hours; total quantity of coal consumed, 250 lb.; average consumption of coal per hour, 62.5 lb.; average dynamo load in kw.-hours, 40.1; average b.h.p. of engine, 63.26; fuel per kw.-hour, 1.56 lb.; fuel per B.h.p.-hour, 0.986 lb.; cost of Scotch anthracite, 22s. per ton; cost of fuel per kw.-hour, 0.184d.; cost of fuel per B.h.p.-hour, 0.116d.; total klinker and ash, 25.5 lb.; efficiency of dynamo at two-thirds load, 85 per cent.

Thermal efficiencies:

$$\frac{\textit{Electrical energy at terminals}}{\textit{B.t.u. in fuel}} =$$

16.25 per cent.

$$\frac{\textit{B.h.p. energy}}{\textit{B.t.u. in fuel}} = 19.2 \text{ per cent.}$$

Following is an analysis of a sample of Scotch anthracite used: Ash, 4.23 per cent.; moisture, 2.11 per cent.; volatile matter, 9.59 per cent.; fixed carbon, 84.07 per cent. The calorific value of this coal was 13.556 B.t.u. per pound, and 7531 calories per kilogram.

Crushed steel is used as an abrasive. It is produced by one concern only in the United States.

Freighting Ore with Big String Teams

By George C. McFarlane*

In no other section of the country is the art of driving horses and mules in long teams as well developed as in the outlying camps of southern California. The California practice could be imitated to advantage in many mining sections, where a long wagon haul is necessary to get in supplies and haul out ore and concentrates to the railroad.

At first the practice of freighting with big teams was confined to the comparatively level valley and desert sections, where it was not difficult to herd a long string of stock along the straight level roads. Gradually, however, the little details of handling the stock and fitting out the ore wagons and rigging have been perfected, until now 12- and up to 20-horse teams are worked by one driver on mountain roads, where an inexperienced driver might have difficulty in handling a team of fours.

Hauling Borax in Ventura County

The borax haul from the mines in Ventura county to the railroad station at Bakersfield is a good example of cheap wagon transportation over difficult roads and under rather unfavorable conditions. From the mines on the south slope of Mt. Pinos to the railroad station is 65 miles by road. Leaving the mines the road follows through the foot-hills for 10 miles, then climbs the divide and skirts along the range to the head of the Tejon cañon, follows down the cañon to the San Joaquin valley, thence across 35 miles of sand and adobe plain to Bakersfield.

The freight rates over this road vary from $10 to $12 per ton for outgoing borate, and from $6 to $10 for incoming machinery and supplies. The freight rates vary with the price of hay and barley. In favorable years a good deal of feed is raised in the little mountain valleys along the road; in dry years the ranchers have no surplus to sell and all the feed must be hauled from the railroad station and distributed at way stations on the inbound trip. In laying out a road for this class of traffic considerable attention should be paid to curves, particularly where they are on steep grades; on straight stretches or on moderate curves, grades are not so important, as on heavy grades the driver can drop the trail wagons and pull them separately.

On fairly level stretches curves of 30 ft. radius are permissible. On these sharp curves the grade should be widened to about 18 ft. so that the pointers of the team may have a chance to work. It is good policy to have most of the curves of over 200 ft. radius; then the driver can keep things moving without continually putting the pointers over the chain.

On the Ventura borax road few of the grades exceed 8 per cent., although there are two or three short stretches of 12 per cent. grade. The teams will handle the full load on grades up to 8 per cent.; when the grades are steeper than this the trails are dropped and the load pulled in two sections.

After heavy rains parts of the road get heavy; at times the big lead wagons will go down in an adobe mudhole and stick so hard that it takes 30 head of stock to pull it out. During three months of the rainy season proper no attempt is made to send out regular teams and most of the stock is turned out to pasture in the valley. Before the present depression in the borax trade about 500 head of stock were kept on the road hauling ore by the two mines in Ventura county. The teams ranged in size from 10 to 18 head; occasionally 20- and 22-horse teams were put over the road. Fourteen-animal teams seemed to have the best success on this road, larger teams requiring exceptionally skilful drivers to handle them on the sharp curves and heavy grades of the mountain section of the road. The stock used on this road is about equally divided between mules and horses; some of the teams are straight mule teams, others are all horses, while the greater number are mixed mule and horse teams. As a rule the mules are lighter than horses and will not pull as many pounds of ore as an equal number of horses; they require just as much feed in proportion to their size as a horse, but require less care and attention. Horses, on account of their size, make the best wheelers and generally make good line leaders; mules, however, work better as pointers, being very quick and nimble in skipping over the chain on curves.

A Freight Outfit

A 14-animal freight outfit will consist of three wagons and a two-wheel feed cart, and will haul from 12 to 14 tons of ore; about 6 tons in the lead wagon, 4 tons in the first trailer, and 3 tons in the second. The lead wagon will have 2⅝-in. square steel axles, 7-in. tires and will be fitted with strong double brakes; the ore-bed being 2-in. plank strongly ironed. The sides are usually flashed with sheet iron and the bottom covered with dump boards laid crosswise. Through bolts run under the dump boards the full length of the box, and before any ore is loaded these bolts are tightened up to hold the dump boards close together to prevent the fines from sifting through. The running gear of a wagon of this size will cost about $300 and the ore bed $75 to $100. The trailers are smaller editions of the lead wagon and are fitted with single brakes, the lead wagon brakes being set with a long lever. A strap runs from this lever and is snapped to the saddle of the wheel horse, the brake being controlled entirely by the pull of the driver on the strap. The first trail-brake handle sets in a quadrant with a patent dog, and a small line runs from the handle of this brake to the driver. By pulling up on this line and quickly slacking off, the brake is set and dogged, by pulling up and slacking off slowly the brake is released. The hind trail-wagon brake is used only on heavy grades and in these cases the driver goes back and sets it just before the grade is reached. For convenience in coupling together the trail wagons are fitted with a short sliding draw-head; a horn or tail piece projects out about 2 ft. from the hind axle of the lead wagon to receive the draw-head. In going around a sharp curve this tail piece swings out laterally with the short tongue of the trailer and causes it to track the lead wagon instead of cutting across on a chord of the curve.

The draw chain consists of a number of eye-bars connected by short links, with slip shackles at every third stretcher. It is fastened to the hind axle of the lead wagon, passes through a stirrup under the front axle and a loop under the tongue. All the animals except the wheelers are hitched to stretchers attached to the draw chain. With a 14-animal team it would be necessary to have two or possibly three sets of pointers; the pointers are hitched on in front of the wheelers and are free to swing from side to side or jump across the chain. All the other pairs up to the leaders are hitched to the stretcher immediately in front of them; with them it is simply a game of follow the leader, and the only way they can get tangled up is by the leader's slacking up.

Handling the Team

In handling the team the driver rides the left-hand wheeler, holding the brake strap over his left shoulder with the left hand and guiding the team with a jerk line held in the right hand. The two leaders are fastened together with a jockey stick and the line passes back from the bridle of the near leader through loops in the bridles of the swing animals to the driver, not being fastened to the pointers in any way. The line leader is guided more often by words than by the line; on gentle curves the outer pointers are called by name and they swing around sideways to the chain and single point. On sharp curves the pointers on the inside of the turn are put over the chain by flipping the jerk line over them, striking them on the side of the head

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opposite to the way they are wanted to jump; as soon as they are over the chain the pointers pull off at an angle—on very sharp turns almost at right angles.

With three pairs of pointers working in this way, I saw a 16-horse team with three ore wagons and a feed cart turn around in a road 60 ft. wide. In making up a big team it is necessary to have a trained line leader and at least one set of well-broken pointers; the rest of the stock need not be accustomed to working in big teams. For the first couple of trips a green team will have to be loaded light and one or two swampers must be in attendance. The swampers club the pointers over the chain on the turns and handle the brakes on the bad turns and heavy grades. In two or three weeks a good driver will have the team trained so he can handle it alone.

Unlike the freighters in Montana and Idaho, who can turn the stock out at night to rustle most of their feed on the range, the borax haulers have to buy all feed, and instead of timothy and oats, they have to be satisfied with wheat, hay and barley, and pay big prices for it besides. Even with this handicap, they are wagon freighting cheaper than in any place in the country and the teamsters are paid the highest wages, i.e., $100 a month and expenses and more. Even the big oil-burning traction engines have not been able as yet to freight as cheap as the long-line skinners.

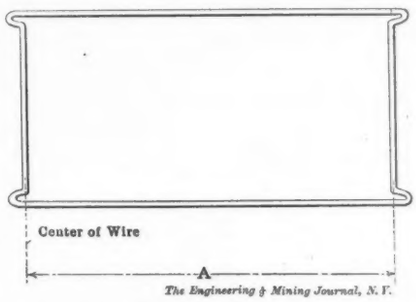
To get the best results, it is necessary to get the best wagons and equipment and keep them right up in shape all the time. As soon as the wagons and stock begin to run down, they must be replaced by new ones. In figuring out freighting costs, the companies consider that a freight outfit lasts four years, so that after an outfit was run two years it can be sold to ranchers for about half of its original cost. In general, all freighters figure on selling and trading their horses and wagons and getting new ones as often as possible, for it does not pay to keep a poor outfit on the road. For the same reason only the most careful and skilful teamsters are employed and once a man has established a reputation he can generally command his own price. The monthly expense of keeping a 14-horse team on the road averaged in 1907 about as follows: Wages of driver, $100; board and road expenses of driver, $35; shoeing the stock, $32; wagon repairs, tire-setting, etc., $25; feed (5 tons wheat hay at $12), $60; 4 tons of rolled barley at $32, $128; total, $380.

A complete 14-animal freight outfit costs in California from $3500 to $4000, and since it lasts only four years, the monthly depreciation would be about $80. This, added to the running expense, makes the total monthly cost $460. On an average the 14-animal teams hauled out 41.2 tons of borate ore and 6 tons of inbound freight, a total of 47.2 tons. This makes the actual cost of hauling a ton 65 miles, $9.75.

A Balloon Survey

By Walter S. Weeks*

The difficulty and inconvenience of measuring the hight of the back in high stopes by means of swaying rods led me to try the use of balloons for that purpose. During the summer of 1908 the method was given a trial at the Harvard summer school of mining at South Strafford, Vt. The scheme was successful. The idea was to let the balloon, to which a thread was fastened, rise to the back of the stope and then to measure the length of the thread between the bottom of the balloon and the floor. This length plus the diameter of the balloon gave the hight of the stope. The thread was measured by winding it upon a reel of known size, and counting the number of turns.



SKETCH OF REEL. 2 × A + CIRCUMFERENCE OF WIRE = 2 FEET

The following is a description of the outfit necessary for the work: The balloons are the ordinary toy variety costing 5c. each. They are purchased uninflated and are filled with hydrogen gas when they are to be used. The hydrogen gas can be obtained from dealers in chemicals. It costs 5c. per cu.ft. It can be purchased in cylinders holding 50 cu.ft. The gas in the cylinder is at such a pressure that it will easily inflate the balloons. The choice of the thread which holds the balloon is very important. One balloon will lift but a small amount of ordinary cotton string. The proper thread to use is No. 100 glacé thread. This is light and very strong. A well inflated balloon will lift 70 ft. of this thread.

The measuring reel is made of heavy wire. A convenient size for the reel is such that one complete turn is equal to 2 ft. A sketch of the reel is seen in the accompanying illustration. A reel with a spindle was tried but was found to be inferior to the simple reel shown. It is necessary to follow the course of the balloon with a light of some sort. For this purpose a good acetylene bicycle lamp will answer. The round, shiny surface of the balloon catches and reflects the rays of the light so that the balloon can be seen when it is many feet in the air.

Preparing and Handling the Balloon

Stretch the neck of the balloon over the nozzle of the hydrogen cylinder. Hold the balloon securely while the gas is gently turned on. Inflate the balloon until it is about 10 in. in diameter. Tie a piece of soft cotton string about the neck of the balloon and remove it from the nozzle. Stretch the neck, double it back and tie again. Cut off all loose ends of the string to avoid weight. Fine thread cannot be used for securing the neck, as it cuts the rubber.

Attach the balloon to thread that is wound on the reel. Take the balloon beneath the back to be measured and allow it to ascend. When it has reached the back, unwind the thread until the reel can touch the floor directly beneath the balloon. Now hold the reel firmly in the left hand, and with the right pull down the balloon and wind up the thread, carefully counting the number of turns. The length of the thread plus the diameter of the balloon equals the hight of the stope.

If the stope is windy, let the balloon up to the back and it will soon catch in some irregularity. Then walk under the balloon and measure. If the stope is inclined it will be found that the balloon will work up along the hanging wall. The dip of the thread can be taken with a clinometer and the slope distance converted into the vertical distance. By stretching a tape between survey stations and taking balloon measurements every few feet, an accurate contour of the back can be obtained.

Powder smoke should be blown out of the stope before any high measurements are attempted as the balloon can be seen only a short distance through the smoke. Lighted candles should be kept away from the balloon as the hydrogen explodes with some violence when ignited. Keep balloons as dry as possible as drops of water add weight.

Balloons will remain inflated about two hours. It is not worth while trying to reinflate them. If one balloon will not carry the thread to the required hight, put on another one.

*Assistant in mining and metallurgy, Harvard University, Cambridge, Mass.

A new development in the alloying of aluminum with other metals (*The Metal Industry*, May, 1909) has just been accomplished by the production of "silverite." This metal is something entirely new and is composed of a mixture of aluminum, copper, zinc and steel in varying proportions according to the requirements. The resulting metal has a specific gravity of 3.1, a tensile strength of from 40,000 to 45,000 lb. per sq.in., and a compression resistance of 100,000 pounds.

Pyrite Smelting by Knudsen Method in Norway

When Sulphide Ore Is Roasted, Using Heavy Air Current, It Partially Melts, and Pure Metallic Sulphide Gathers on the Hearth

BY E. KNUDSEN*

Much time and much money have been spent on the problem of pyrite smelting, and but slow progress has been made. This may partly have depended on the diversity of ore, necessitating different treatments; what is suitable for one ore may not be applicable for another. In the development of the Knudsen process at Sulitjelma, Norway, this was well observed, for experiments with very different ores were made during the course of the year and furnished a good guide.

Outline of Method

The Knudsen process depends on the fact that when sulphide ores are roasted under the influence of a powerful air current the ore melts partially, and the pure metallic sulphide flows out and gathers on the hearth of the furnace. The construction of the furnace is shown in Fig. 1. The idea is to accumulate a small bath of melted ore as soon as possible by means of the air blast; by the production of a strong oxidation in this bath a very high temperature is produced which then acts on the remainder of the charge.

The temperature attained in this process is so high that sulphide ore, even rich in silica, becomes entirely fluid. The tremendous heat, particularly in the last period of the concentration, renders it necessary to employ very thick linings of refractory material. The heat remaining in the furnace after the matte and the slag are removed is sufficient to kindle the new charge. The amount of coke or coal employed is very small, ranging from 0.5 to 1.5 per cent. of the weight of the ore, according to the nature of the latter. This quantity of coke is not particularly necessary for carrying out the process, but it serves to hinder the stiffening of the first, small, metal bath by the blast. The introduction of the air plays an important part in the process.

To charge the furnace, the estimated quantity of coke or coal is first introduced; this is then subjected to a strong air blast, whereby the fuel becomes red hot. The upper half of the furnace is connected with the hopper, which is then opened, and the charge falls into the furnace. The air blast is then maintained at a pressure of about 5 lb., the tuyere being well cleaned so that it does not form a nose. When the bath of melted iron sulphide reaches the tuyere, the air pressure is increased to 10, 15 and even 22 lb. in some cases. In from 1½ to 2 hours, the whole charge is ordinarily melted and concentration begins; in from 3½ to 4 hours a matte is ready, containing from 40 to 50 per cent. of copper. The furnace is then tipped horizontally and the contents poured out into the forehearth.

Experience at Sulitjelma

It is now six years since the first experiments on a large scale were made at Sulitjelma and progress is slowly but surely being attained. At first a furnace of about 7 tons capacity was erected; then one to treat 10 to 12 tons, and finally one that had a capacity of from 15 to 20 tons. When I say 10 to 12 and 15 to 20 tons, the reason for this is that the ores are not of the same bulk, on which account it would be more correct to state the furnace size in terms of its interior volume, e.g., 6 cu.m. and 10 cu. meters.

The durability of the furnace can be seen in the following statement: The small furnace, in the period from Feb. 18, 1907, to April 9, 1908, made nine runs which, while they treated different tonnages, still showed an increasing duration.

The larger furnace generally gave a longer run, apparently in proportion to its capacity, and it required less repair. The big furnace permitted 179 to 202, and even up to 459 charges per run. While the smaller furnace required for repairs approximately 1½ magnesite brick per ton of ore, the maintenance of the large furnace needed only one brick per ton. It is to be remarked that after removal the old brick were crushed and used for lining the hearth in the slag receptacle.

DURABILITY OF FURNACE.

Run.	Magnesite Brick Used in Repairing Furnace.	Number of Charges.	Tonnage Smelted.
1	2,184	81	734.4
2	1,456	139	1,399.8
3	1,880	96	942.1
4	1,220	86	859.7
5	1,975	70	628.4
6	1,522	109	1,013.8
7	1,960	218	1,733.7
8	2,150	189	1,407.4
9	2,076	124	1,000.8

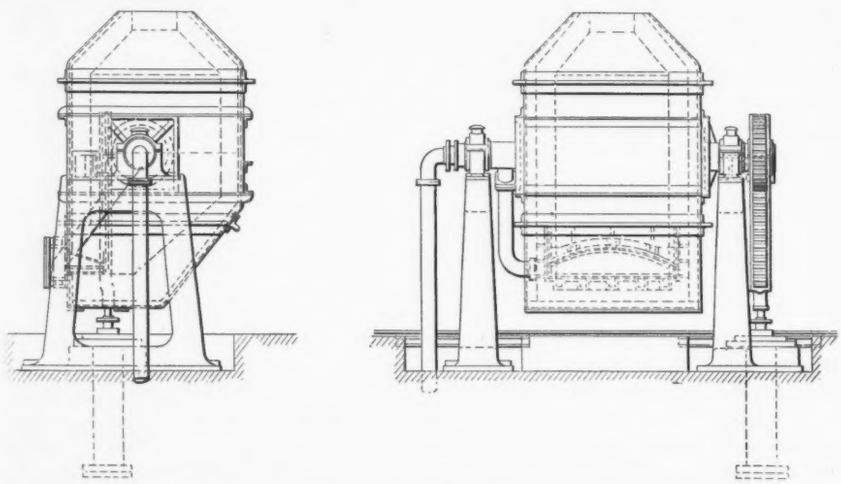


FIG. 1. KUNDSEN FURNACE OF 8 TO 10 TONS CAPACITY

This represents the furnace as first constructed by the author. At present larger furnaces are used of a modified form which have been found more satisfactory.

Nature of Ores Smelted

The ores of Sulitjelma may be divided in two classes: Pure silicious ore and ore that is partially chloritized. The average analyses of each class are given in the accompanying table.

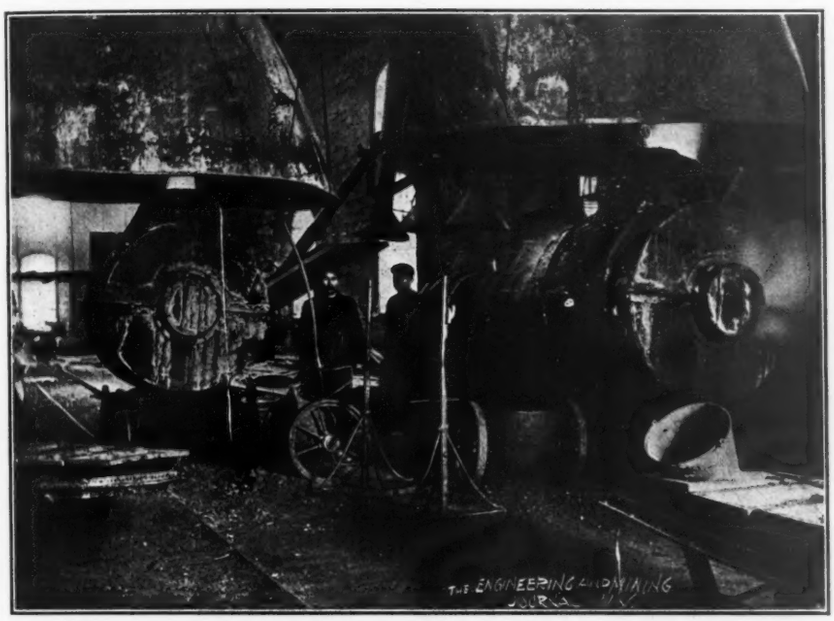
ANALYSES OF SULITJELMA ORES.

	Silicious.		Chloritized.	
Copper	6.47%	6.45%	5.15%	5.11%
Iron	32.74	32.90	25.64	27.10
Sulphur	33.87	39.90	22.64	25.30
Silica	16.75	16.20	31.38	26.30
Alumina	10.17	8.50	12.21	12.20

*General manager, Mitterberger Kupfer Aktiengesellschaft, Ausserfelden, Salzburg, Austria.

NOTE—From advance sheets of "The Mineral Industry, Vol. XVII.

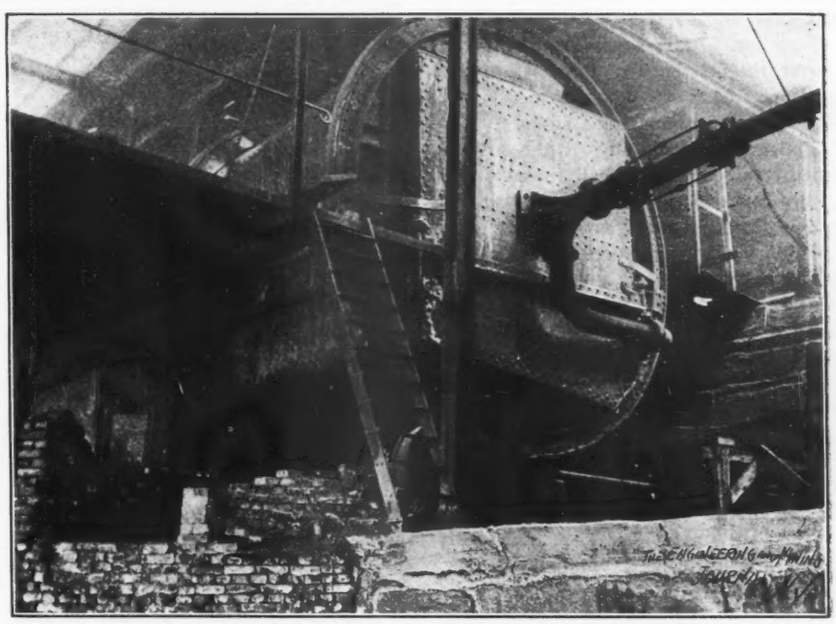
Our experience has shown that when a silicious ore is smelted, an easily fusible slag results, which, on being retained for about 20 min. in the horizontally placed furnace, gives a slag containing only from 0.5 to 0.6 per cent. copper. When, however, a large quantity of the chloritized ore is treated, the slag becomes thick and must be held for a longer time in order to separate completely the particles of matte blown into it by the blast. For this purpose a forehearth is provided into which the charge is poured and allowed to remain for about 90 min., after which the slag is run off and granulated while the matte is tapped into a Manhés converter.



COPPER-BESSEMERIZING

Certain other ores had the disadvantage of decrepitating, which caused the charge to fall into a more or less powdery state, and then fuse together. If a considerable part of the charge should then fall into the molten bath at once, sharp explosions would occur, which, to the uninitiated, would seem dangerous; the only damage, however, was the freezing of the bath, if the falling mass of charge were too large. Whenever this accident occurred, we would tip the furnace to the horizontal and put a few kilograms of coke and 200 to 400 kg. of crude ore in range of the tuyeres; on replacing the furnace vertically and turning on the blast, the charge would again become normal. We have, in fact, smelted charges consisting of one-third lump ore, one-third fine ore and one-third dust, with success, but when so much fine material is introduced into the furnace the charge is bound to sinter somewhat.

We also experimented with slimes from the Elmore vacuum process, briquetted for smelting, with excellent results. The Elmore slimes were mixed with 4 per cent. of milk of lime, pressed with a primitive ramming apparatus, and placed for 12 hours in a drying chamber. The briquettes were thereby rendered so firm that they withstood the hardest knocks, and did not fall apart when introduced into the Knudsen furnace. In 2½ hours of smelting a matte was obtained with 38.5 per cent. copper. When much fine ore has to be treated, it is best to divide it, taking the smaller portion to make into briquettes, drying but not burning them, before putting them into the furnace. This insures a quiet operation without unpleasant disturbances.



THE KNUDSEN FURNACE (20 TONS) DURING THE SMELTING OF THE CHARGE

We have smelted ores high in silica and low in sulphur and iron, for example, with 20 to 21 per cent. of sulphur, 32 per cent. of iron and 40 per cent. of silica. These ores smelted satisfactorily and gave a clean slag, but they were hard to kindle on account of the small amount of sulphur in them; this fact required the addition of 2 per cent. of coal and coke, but as soon as the bath of iron sulphide came in front of the tuyeres the oxidation of the iron furnished the necessary heat.

Experimental Results

The composition of the matte during these experiments ranged from 45 to 56 per cent. copper, and the slags of a number of charges contained, respectively, amounts of copper and silica shown in the accompanying table. If the matte and slag be allowed to remain for a time on the hearth, and it has been indicated that a duration of 1 to 1½ hours is best, the matte particles can then be successfully separated. It is advantageous to place some pulverized, pure silicious ore on the hearth in order to render the slag cleaner. It also has a good effect on the matte, which is sometimes produced too profusely if it has formed a crust on the walls, and for this reason has had to be tapped more slowly. A matte with 65 to 70 per cent. of copper might be obtained, which, however, is not well adapted for the Manhés converter; by adding this raw ore, the copper contents can be brought down to 55 or 60 per cent., which can then be bessemerized very well.

Composition of the Slag

As previously stated, the fluidity of the slag is the deciding factor. With a well-

acting furnace and with ores giving an easily fusible slag, no forehearth was found to be necessary. But in metallurgical processes things so often take place unexpectedly, that I do not consider it advisable to work without the forehearth.

SLAG ANALYSES.

Copper.	Silica.	Copper.	Silica.	Copper.	Silica.	Copper.	Silica.
0.52%	34.46%	0.48%	34.47%	0.53%	34.97%	0.46%	32.00%
0.61	36.91	0.40	34.35	0.63	33.66	0.42	31.49
0.49	37.68	0.38	35.35	0.65	32.56	.....	.....

The slags at Sulitjelma are commonly monosilicates, with from 28 to 32 per cent. silica, 56 to 59 per cent. iron oxide, 10 to 12 per cent. of alumina, about 1.5 per cent. sulphur, and from 0.3 to 0.6 per cent. of copper.

Experiments were made by allowing the slag to flow into large iron pots, and fine results were obtained for a day at a time, until suddenly the slag would become thicker, and the separation of matte particles would be incomplete. Such surprises do not occur in a forehearth heated by generator gas. I have observed that slags with 32 to 36 per cent. silica carry the least amount of copper. We have had slags that, on being granulated, contained only 0.29 per cent., but ordinarily they varied from 0.4 to 0.6 per cent. in copper.

Composition of the Matte

The matte ordinarily produced at Sulitjelma has a copper content of 50 to 55 per cent. and contains 20 to 21 per cent. of sulphur. After tapping into the converter, the first hour's treatment produces a copper 99.25 to 99.5 per cent. pure The copper contains some silver.

The greatest difficulty of the process, when conducted in a small furnace, is to secure a matte which shall not vary too widely from the average. Wall accretions are more likely to occur, involving a longer blowing; and, thereby, a richer matte unsuited for the Manhés converter. With a large furnace, this last difficulty is less pronounced since the charge sinks regularly and permits the formation of a matte with any desired copper content. With charges low in iron, it is important not to blow too long, making a matte high in copper, since there is danger of freezing the charge.

When the charge has been sufficiently blown, the furnace is emptied at once, and after a few minutes the matte runs into the converter. We have often made a finished bessemer copper within 5 hours after charging the furnace, and sometimes within 4½ hours.

Lining of the Furnace

The durability of the lining depends altogether on its construction. The magnesite brick must be closely united, so that the joints are reduced to a minimum, and special mortar must be used. The fragments of the brick from the lower part of the furnace are used partly for repairing the upper part when necessary (which is not often), and some are broken up for lining the forehearth. Magnesite is especially necessary for the lower part of the furnace, up to 1.25 m. above the tuyere. It is the back of the furnace that suffers most. We have, for example, repaired the large furnace twice, above the tuyere, with 600 to 800 brick, and with these two small repairs have smelted 9000 tons of ore. The magnesite mortar is mixed with tar and applied very warm.

Air Blast

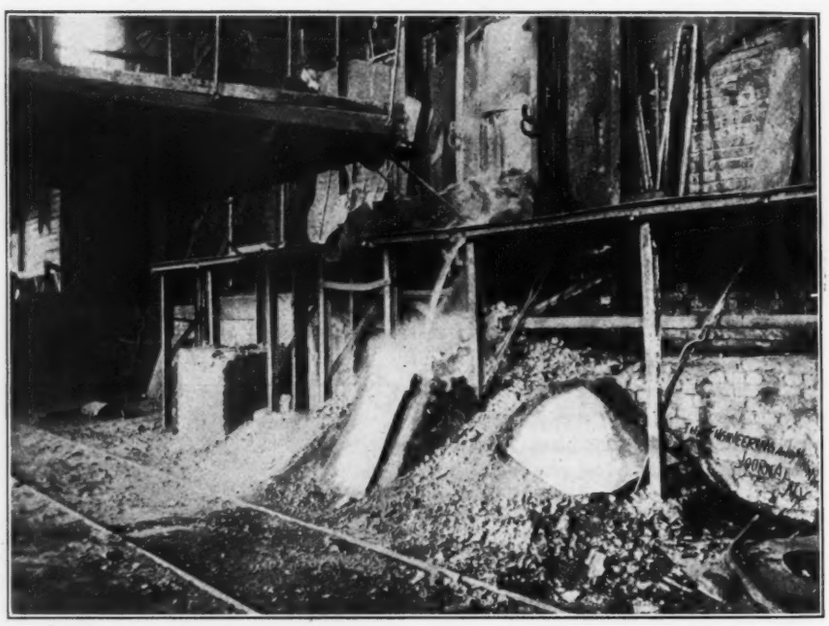
The blast pressure is variable, ranging from ¼ to 1 atmosphere, and often to 1 1/3 to 1½ atmosphere. A good deal depends on this as to how the charge starts. When care is exercised in the beginning, and not too much air is given during the first hour, a charge will generally settle down in a regular manner, and will then work well with a pressure of one atmosphere. When the charge hangs back and crusts are formed, it is necessary to use a higher pressure, whereby the melted bath is strongly agitated and the crusts go into solution.

The power necessary for blowing a Knudsen furnace, of about 12 cu.m. capacity, is as follows: In the first 1½ hours, not far from 40 h.p. is needed; in the next 1 to 1½ hours, 80 to 100 h.p., and in the last hour of the blast, 150 to 160 h.p., and in a few rare cases, 200 h.p. A furnace of 12 cu.m. capacity treats 20 to 25 tons of ore, and inasmuch as at least four charges in 24 hours can be reckoned, the power required is not large per ton of ore smelted, particularly as a pause of about 1 hour takes place between every two charges, for cleaning the furnace and burning the coke and coal, when practically no power is consumed. Having steam facilities, the feed water can profitably be warmed by gases given off from the furnace, as I have practically demonstrated.

Waste Gases

The gases given off in the beginning of the process are not very hot, but they soon increase in temperature; at a distance of 10 m. from the mouth of the furnace, we have measured, with a pyrometer, temperatures of 600 to 780 deg. C., toward the end of the process. The radiation from the lining of the furnace, after it has been emptied and again set upright, is so great that we have measured 180 deg. in the outlet channel distant 10 m. from the mouth of the furnace.

The percentage of sulphurous acid in the gas has often been determined. From the nature of the process, the percentage is somewhat variable, but the gases from a charge show an average between 6 and 7 per cent., by volume, of $SO_2 + SO_3$. The amount has been determined to be from 2½ to 11½ per cent. by volume, and was, in the last instance, 9 to 9½ per cent. dioxide and about 2 to 2½ per cent. trioxide.

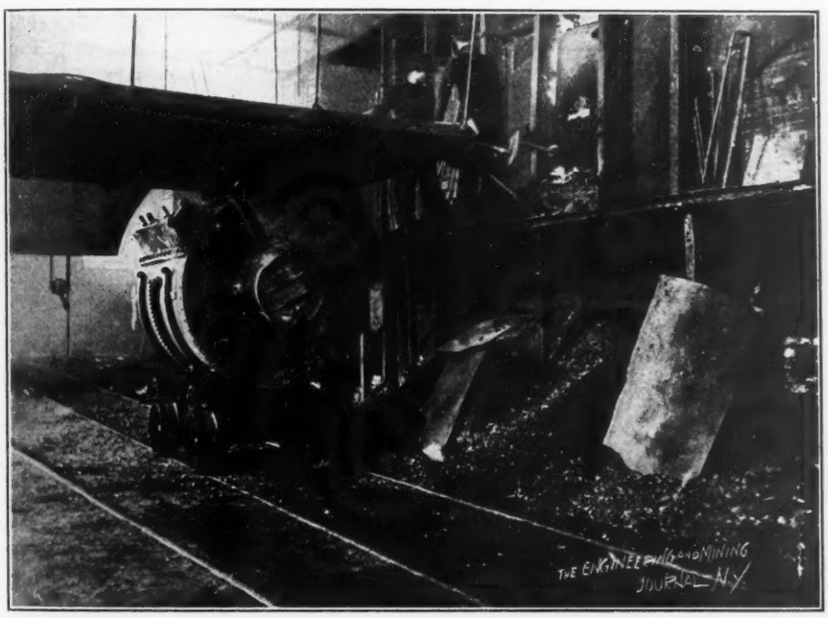


GRANULATING THE SLAG

Fuel

The coke and coal consumption depend on the cross-section of the lower part of the furnace, and not on the size of the charge. Thus if a 20-ton furnace be charged with only 12 or 14 tons, the same amount of coke must be used as though it were filled with 20 tons. As previously stated, with ores difficult to kindle the coke consumption rises to 2 per cent., while ordinarily it is less than 1 per cent.

For a charge of from 20 to 25 tons, there are required, per ton: 0.1 ton of coke; 0.1 ton of coal; 15 pieces of magnesite brick, to repair the furnace; and 20 pfennings (5c.) worth of tools, tar, etc. The heating of the forehearth also requires, per 24 hours, about 2¼ tons coal and ¼ ton wood. It is to be noted that one forehearth is sufficient for two or even for three Knudsen furnaces.



THE MATTE IS TAPPED INTO MANHES CONVERTER

Labor Employed

The running of the Knudsen furnace requires two men per shift. These can attend to the charging, smelting, pouring out and also the cleaning. It is their duty to see that the charge is placed in the hopper over the furnace, ready for use, and that the coke and coal are on the grates. A foreman can easily look after two or three Knudsen furnaces. The generator and the forehearth can also be attended by two men per shift.

Cost of Operation

The cost of smelting with a plant of two furnaces of 20 tons each, and one forehearth, with a generator, at normal prices for labor and materials, is about three marks (74c.) per ton of ore smelted, for the Knudsen furnaces, and 0.70 mark (17c.) per ton for the management of the forehearth. Air compression is reckoned in, as are the chief repairs that are occasionally necessary to the hearth and the furnaces. In this statement, wages are reckoned at 5 and 4 marks per shift and the coke at 35 marks per 1000 kg., coal at 20 marks per 1000 kg., and magnesite bricks at 1 mark apiece.

It has been thoroughly proved that in the Knudsen process the loss of copper is less than in the former process of roasting and smelting of roasted ores in water jackets. This copper loss has been reduced by about 45 per cent. The smelter report, covering a run at Sulitjelma of over 115 charges, from Sept. 26 to Oct. 31, 1908, furnishes the following data: The ore charges varied from 8.3 to 15.4 tons, but were chiefly from 12 to 14 tons. The coke and coal used was 0.2 ton in practically every charge. The time required was from 2 hours, 35 min., to 6 hours, with an average in the neighborhood of 4 hours. In every case the charge stood for 1½ hours in the forehearth. In practically every case 0.5 ton of Elmore slimes was charged in the hearth. The copper in the slag from hearth ranged from 0.4 to 0.66 per cent. Copper in the matte ranged from 34.4 to 73.3 per cent. The majority ran from 40 to 60 per cent. The generators required from 2 to 2.5 tons of coal and from 0.25 to 0.35 tons of wood per charge.

During the last three years, all smelting ores in Sulitjelma have been treated in Knudsen furnaces. The rich slags, however, were smelted in a water jacket, but this practice will be discontinued. During 1907, at Sulitjelma, 10,141 tons of ore were smelted, and all of this in Knudsen furnaces. The cost was as follows, in Norwegian crowns ($0.27) per ton: Unloading, transportation and carrying of the ore, coke, etc., into the works, 0.73; lining the Knudsen furnaces, 1.69; smelting (including air compression), 1.48; repairs, etc., 0.48; total, 4.38. For 1908 the cost of smelting appeared to be less.

As previously explained, the small furnace is uneconomical, for it requires the same attendance as the large one, and the amount of combustible material is about the same. It is therefore advantageous to use the larger furnace and to connect two of them to one hearth, thus insuring a cheaper production per ton of smelted ore. Experiments on the smelting of pyrrhotite ores containing nickel are well under way; copper ores, also, containing zinc blende have been smelted to a matte without difficulty, and with good results.

In selling iron and steel, says the Cleveland *Iron Trade Review*, the net ton—of 2000 lb.—is the most generally used, and where such is the case, basing quotations are on one or 100-lb. quantities, as for instance, 1.30c. Pittsburg per lb., or $1.30 per 100 lb. on plates, 1.15c. or $1.15 Pittsburg, on steel bars, etc. Most of the finished lines including plates, sheets, skelp, merchant bars, hoops, bands, shapes, tubular goods, wire, nails, etc., are sold at net tons. In tinplate the basing prices are on the 100-lb. box and in cotton ties, on the bundle. Fixed ton prices are the rule where products are sold on the 2240-lb. or gross-ton basis, which is the case with semi-finished steel, such as billets, sheet-bars, slabs, wirerods, etc., muckbar and old material. Scrap, however, is sometimes sold by net tons and skelp is sometimes dealt in at gross tons. Rails are about the only finished product to which the gross ton applies.

The iron-ore deposits of the Briey basin in France were first opened in 1898. The first shipments were made in 1899, amounting to 102,131 metric tons. In 1905 the shipments reached 2,352,848 tons, and in 1908 they were 4,580,223 tons. The Briey ores are similar to the minette ores of Luxemburg. They average about 35 per cent. metallic iron and carry lime enough to make them self-fluxing. The percentage of phosphorus is too high for pig iron made from them to be used in the acid-steel process, but they make excellent basic pig.

Russian platinum exports in 1908 (*Chem. Trade Journ.*, April 17, 1909) amounted to 321 poods, valued at 9,658,000 rubles, as compared with 298 poods, valued at 6,930,000 rubles in 1907.

The Coal Dust Question in Great Britain

Reviewing Efforts of the Early Investigators, and Showing How Present Legislation Has Reduced the Number of Gas and Dust Explosions

BY HENRY HALL*

Notwithstanding the many practical demonstrations showing the explosive force of coal dust, the mining world has been very slow to acknowledge and accept the position as one that positively demands a radical change of existing methods of mining. For a period extending over 60 years, from about 1845 to the present time, many scientific experimenters have endeavored to convince practical miners that fine coal dust was as much to be dreaded and guarded against as firedamp itself, but it is only during the last 10 or 15 years that this view has become so generally accepted by those responsible for the safety of the workers in coal mines.

The earliest experimenters were content to point out that coal dust (dusty roads) augmented the force and intensity of firedamp explosions. Professor Faraday lecturing at the Royal Institution on the circumstance of an explosion at Haswell colliery in 1844, expressed his opinion of the disaster in the following words: "The ignition and explosion of the firedamp mixture would raise and then kindle the coal dust which is always pervading the passages, and these effects must in a moment have made that part of the mine which was the scene of the calamity, glow like a furnace."

In the same lecture, the following interesting paragraph appears, forecasting nearly the whole of the phenomena since proved to be actual and true: "In considering the extent of the fire from the moment of the explosion, it is not to be supposed that firedamp was its only fuel; the coal dust swept by the rush of wind and flame from the floor, roof and walls of the works would instantly take fire and burn if there were oxygen enough present in the air to support its combustion; we found the dust adhering to the faces of the pillars, props and walls, in the direction of and on the side toward the explosion, increasing gradually to a certain distance as we neared the place of ignition. This deposit was in some parts half an inch thick, in others almost an inch thick; it adhered together in a friable coked state. When examined chemically and compared with the powdered coal, it was found deprived of the greater proportion of the bitumen, and in some instances entirely destitute of it. There is every reason to believe that much coal gas was made from this dust, in the very air itself in the mine, by the flame of the firedamp which raised and swept it along, and much of the carbon of this dust remained unburned only from want of air."

Coal Dust Was Not Considered in Itself Explosive

This description of a coal-mine explosion in 1844 is quite consistent with the later knowledge gained on the subject, except that it takes no account of the fact, now established, that coal dust and air in certain proportions are capable of being exploded, and causing a disaster in the entire absence of firedamp. In 1844 and for several years afterward the part played by coal dust was held to be a simple aggravation of the firedamp explosion, merely adding fuel to the flame, an irresistible and natural conclusion, in the absence of knowledge of its explosive qualities.

During this period the coal mines were generally of no great depth, surface water percolating and keeping the stratifications wet, and any dust raised in the operation of coal-getting quickly became damp and innocuous. When deeper and dry seams had to be opened up, where in consequence of the greater depth the natural temperature of the strata was comparatively high, then the dust question became a serious one. In mines of this character, fine dry coal dust accumulated from day to day and was strewn by the traffic and ventilating currents throughout the whole of the galleries, adhering to, and remaining as a coating or covering on all projecting parts, and where no steps were taken for its removal, I have frequently seen it lying 6 or 8 in. thick along the sides of the main roads for considerable distances, while the lighter and finer particles were deposited in a substantial layer on both roof and sides. Passing along such roads, the sensation is that of walking on a velvet carpet. In an extended interval of time, there must be thousands of tons of this combustible material lying ready to be licked up by a passing firedamp explosion, or itself exploded in the absence of any firedamp by a blown-out gunpowder shot.

This was the normal condition of the majority of British coal mines in 1872 and is still the condition of a large number in districts where the coal seams are soft and friable and the underground temperature high. It is remarkable that in the British act of Parliament for the

A COAL-DUST EXPLOSION IN THE EXPERIMENTAL SHAFT IN LANCASHIRE

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regulation of mines passed in 1872, no reference whatsoever is made to coal dust; indeed the word does not occur anywhere in the act. I mention this to show that the coal-dust question did not begin to assume any great importance until subsequent to that date, and no attempt had yet been made to alter or mitigate a condition of things which was generally prevalent in all the deeper mines in the Kingdom.

Explosions Killed 4098 Persons

Great colliery disasters attributed to the presence of firedamp continued to be of frequent occurrence. From the beginning of 1873 to the end of 1892, 4098 persons lost their lives in British coal mines by explosions, and the evidence given at the formal investigations of the circumstances of several of these accidents made it impossible to assign them to the agency of firedamp alone; their magnitude and extension throughout many miles of underground roadways could not be adequately explained on the firedamp theory alone. For some years it was the fashion to try to account for the immense development of force in colliery explosions, on the assumption that a sudden and unforeseen outburst of firedamp had occurred, inundating with explosive atmosphere more or less the whole area of the mine, or in other words that the occurrence was due to an "act of God." This theory failed to hold the field for long because there was an entire absence of any evidence of such a state of things existing, either immediately before, or after the event.

About the year 1875, William Galloway of Cardiff, who at that time held the position of a government inspector of mines, drew attention to the important part played by coal dust in so-called firedamp explosions. This gentleman pursued his inquiries and carried out many experiments and became an able and strenuous advocate of what has been termed "the coal-dust theory."

In a paper read before the Royal Society in 1876, Mr. Galloway stated: "A mixture of firedamp and air, in the proportion of one volume of the former to 112 of the latter, becomes inflammable at ordinary pressure and temperature, when charged with fine dry coal dust, such as that which is to be found on the roadways in dry coal mines."

This conclusion of Mr. Galloway's was confirmed by an elaborate series of experiments carried out under the direction of Sir Frederick Abel, assisted by Mr. Smethurst at a colliery near Wigan at the instance of a royal commission on mine accidents then sitting, and of which body Sir Frederick was a member. I witnessed many of these experiments and although they proved that an atmosphere contaminated with 2 per cent. of firedamp became explosive when it was mixed or carburetted with fine dry coal dust, the experiments were on so small a scale that the more important question, as to whether coal dust and air in the absence of firedamp was explosive was left untouched. The conclusion arrived at by Messrs. Abel and Smethurst is set forth in the following extract from their report:

"Some of these dusts when thickly suspended in air traveling at the velocity of 500 to 1000 ft. per min., and exposed to the action of a large flash of flame, as is produced by guncotton and blasting powder, exhibited a tendency not only to burn explosively in, or close around the flame, but also to propagate flame or cause it to travel along some distance; but the most decisive of the results were not of a nature to warrant the conclusion that flame could be carried along to a very great distance by coal dust in the complete absence of firedamp."

It is not to be wondered at, that a rapidly moving atmosphere made up of air containing 2 per cent. of methane, and intimately mixed with fine dry coal dust should be capable of being inflamed and burned with explosive violence by the intrusion of the flash and shock of a blown-out gunpowder shot, and it is clear that an atmosphere such as this, must frequently exist in parts of dry and dusty mines, where every freshly exposed coal face is constantly exuding firedamp.

Some of the Earlier Experiments

Every great disaster as it occurred gave rise to greater interest in the subject of coal dust and scientists renewed their endeavors to elucidate further the phenomena of colliery explosions. Experimental galleries were installed at considerable cost in Germany, France and England. The German experiments were carried out at Saarbrücken in 1884 by the Prussian Firedamp Commission. At the suggestion, and under the direction of Mr. Hill, one of its members, the gallery used was about 170 ft. long, with a sectional area of 22 ft. In one series of the experiments, dust and firedamp were used; in the second series, dust alone. Mr. Hill submitted certain conclusions as the result of these tests; among others of a less definite character, we find:

"1. The presence of coal dust in more or less abundance in the immediate vicinity of the working face, gives rise to more or less considerable elongation of the flame projected by a blown-out shot, whether small quantities of firedamp be present in the air or not.

"2a. In the complete absence of firedamp the elongation or propagation of flame is generally of a limited extent, however far the deposits of dust may extend in the mineways.

"b. There are, however, certain descriptions of coal dust, which if ignited by a blown-out shot, will not only continue to carry on the flame, even to distances extending considerably beyond the confines of the dust deposits, but will also give rise to explosive phenomena, in the *complete absence of any trace of firedamp*, which, in character and effects are similar to those produced with some other dusts in air containing 7 per cent. of firedamp."

In France in 1882, M. M. Mallard and Le Chatelier published the results of their inquiries into the part played by coal dust in mine accidents. Their researches seem to have led them to conclusions opposed in important respects to those of previous experimenters. They confidently maintained that no coal-mine accident of any importance could be attributed, even with some claim to probability, to the action of coal dust. They also maintained that all explosions of magnitude which have been solely attributed to coal dust have occurred *in mines in which firedamp occurs;* that the possibility of coal dust *per se* giving rise to an important explosion, could only be established by the occurrence of an explosion in a mine in which the total absence of firedamp could be absolutely demonstrated, and that the impossibility of dust alone giving rise to extensive explosions is demonstrated by the fact that lignite mines, which are generally very dusty, the dust being extremely inflammable, but which are at the same time almost free from firedamp, have never yet been visited by accidents of this class.

In England, a royal commission on accidents in mines (the late Sir Warrington Smythe was chairman) sat from 1876 to 1886, and in a report of the latter date, the commissioners stated: "The following facts relating to the part played by dust in coal-mine explosions may now be regarded as conclusively established.

"1. The occurrence of a blown-out shot in working places where highly inflammable coal dust exists in great abundance, may, even in the total absence of firedamp, possibly give rise to violent explosions, or may at any rate be followed by the propagation of flame through considerable areas, and even by the communication of flame to distant parts of the workings where explosive gas mixtures, or dust deposits in association with non-explosive gas mixtures, exist.

"2. The occurrence of a blown-out shot in localities where only small proportions of firedamp exist in the air, in the presence of even comparatively slightly inflammable, or actually non-inflammable but very fine, dry, and porous dusts, may give rise to explosions, the flame from which may reach to distant localities where either gas accumulations or deposits of inflammable coal dust may be inflamed, and may extend the disastrous results to other regions."

The commissioners made the following suggestions for guarding against the danger of blasting in dusty mines:

"1. The removal of dust as completely as possible from the working places.

"2. The provision and thoroughly efficient adoption of simple and effectual

measures for rendering dust innocuous in the presence of a blown-out shot.

"3. The discovery of means for preventing the possible occurrence of blown-out shots.

"4. The adoption of particular agents or of particular methods of using such agents, which deprive a blown-out shot of its danger by insuring the total absence of flame, or of highly heated solid matter when the shot is fired.

"5. The substitution for explosive agents, of similarly efficient methods of bringing down coal and stone which are quite free from the special dangers attending the use of those agents."

These extracts from the various reports, both British and foreign, exhibit only a half-hearted acceptance of the "coal-dust theory" and did not by any means press home the urgency of immediate action; however, the following British act of Parliament for the regulation of mines (1887) did enact certain precautionary measures to be observed in dusty mines as follows: "If the place where a shot is to be fired is dry and dusty, then the shot shall not be fired unless one of the following conditions is observed, that is to say:

"1. Unless the place of firing and all contiguous accessible places within a radius of 20 yd. are at the time of firing in a wet state from thorough watering or other treatment equivalent to watering, in all parts where dust is lodged whether roof, floor or sides, or

"2. In the case of places in which watering would injure the roof or floor, unless the explosive is so used with water or other contrivance as to prevent it from inflaming gas or dust, or is of such a nature that it cannot inflame gas or dust."

Interest in the subject did not cease with this official recognition of the danger to be apprehended from the presence of dry coal dust and great explosions continued to occur from time to time in spite of these new regulations. Messrs Galloway, W. N. Atkinson, J. B. Atkinson, and myself continued our efforts, in and out of season, to convince mine owners and managers of the great risk there was in using ordinary gunpowder for blasting in dry mines. About this time, explosive agents of an entirely different character from gunpowder notably roburite, bellite, etc., began to be introduced and used in some of the mines in Lancashire and elsewhere. I was impressed with the immense difference in the behavior of these new explosives as compared with that of gunpowder; this can be simply and easily demonstrated by placing a charge under a small heap of coal dust; in the case of gunpowder, there is an immense development of flame rising high in the air and consuming the dust, while flame is entirely absent when the charge is made up of the newer explosives.

It was plainly evident that salvation lay in this direction, not only because we now possessed an explosive agent, developing on ignition noncombustible gases, but also, what is equally important, of a nature so rapid in action that the occurrence of the dreaded blown-out shot was almost an impossibility. That much greater security against explosions of gas or dust would be secured by the substitution of the newer explosives for ordinary gunpowder was self-evident, but how to bring this home to those operating the mines was not so easy. Experimental galleries and scientific treatises failed to impress those with whom the power rested to change existing methods. At this time, I commenced a series of experiments in a disused colliery shaft 150 ft. deep, with quite simple accessories, believing that an object lesson on a large scale, the scene being an actual mine, would appeal more directly to practical miners than elaborate and more artificial experiments.

A Practical Object Lesson

The first step to be taken was to make this pit shaft represent as nearly as possible a dry, dusty underground road; with this object in view, ledges of timber were fixed at varying intervals in the shaft, to form resting places for dust, as would be the case in a timbered underground road. When these fittings had been completed and the shaft ready for use, about 2 cwt. of fine coal dust was thrown down the shaft the bulk of which fell to the bottom and went out of action; consequently, only a thin coating of dust was left adhering to the sides of the shaft and to the timbers, ready for action. An iron cannon charged with ¾ lb. of ordinary blasting powder was lowered to the bottom of the shaft and when all was ready the cannon was fired vertically upward by means of an electric battery. A series of six tests was made; at the second trial, the dust was exploded and in an official report dated October, 1890, the phenomenon is described as follows:

"Dust was ignited and a violent explosion took place in the shaft; a large body of flame rushed out of the mouth of the pit, setting the woodwork on fire on the surface and ascending into the air about 20 ft." A note is added: "The electric firing cable was burnt and destroyed and the experiments had to be discontinued." The series of tests were resumed a month later, the dust used being in a blend of highly bituminous coal (Arley seam) from two separate collieries. There were four trials, the dust being allowed to settle in the shaft over a period varying from 20 min. to 2 hours; an explosion of dust resulted in each of the three trials, where gunpowder was the explosive, but at the fourth test, the cannon being charged with 4 oz. of roburite, there was no explosion of the dust. After No. 1 test, the charge of gunpowder was increased to 1 lb., a weight of charge below those frequently used for blasting coal. The last experiment of the series caused the most violent explosion of all, probably due to the shaft which was naturally damp being warmed and dried by the previous explosion.

The scene of operations was now changed to a pit shaft in course of sinking, described as follows: "Depth of pit, 390 ft., diameter, 18 ft." This pit was in course of sinking and was connected with another sinking pit close by, by means of a cut-through in a coal seam at a depth of 300 ft. The cannon was fixed on a scaffold at this latter depth. The shaft sides were wet and dripping and the lower part of the pit, below the scaffold, was full of water. A coke fire was placed on the scaffold causing the experimental pit to act as an upcast, the current of air passing being only at the rate of 30 ft. per min. Weather fine, temperature at surface 68 deg. F. A series of six tests was completed, and although as they proceeded, heavier charges of explosive and more dust were used, in no case was there an ignition of the dust. The cause of this is by no means clear; probably the chief factors were the wet condition of the shaft and its large dimensions (18 ft. diameter.

It has been found that a contracted experimental tube, charged with an explosive atmosphere, is exploded more readily than one of larger dimensions (see official tests for flameless explosives in Germany and elsewhere). I believe that at least three conditions are necessary for the initiation of a coal-dust explosion, viz., a large hot flame in close contact with the dust; rapid vibration of the atmosphere from shock, and a brisk supply of ventilation to continue and develop the primary ignition.

A third series of tests was instituted in a still deeper shaft (630 ft. deep and 8 ft. diam.) and these proved to be the most important and conclusive of all. A scaffold was fixed at a depth of 540 ft. and two cannons, side by side, attached to it. The experimental shaft was upcast from a pumping shaft a little distance away, the ventilation traveled from one to the other through a gallery lined with brickwork, the air moving at the rate of 100 ft. per minute.

An analysis of the air proved firedamp to be entirely absent. Charges of 1½ lb. of gunpowder were used, and from 3 to 4 cwt. of dust were used in each experiment, the bulk of which, lodged on the scaffold or fell to the bottom of the shaft, the active portion adhering to the timbers above the position of the cannons. Two cannons were used with the intention of raising the dust with the first shot and thus getting it into suspension in the air, ready for the second shot, but as events proved, the most successful and violent explosion took place when only one cannon was fired. A preliminary trial shot without dust was fired so that a proper comparison of results might be made.

Results of Experiments

There were in all 16 trials in this deeper shaft; in 9 cases, so far as could be judged, the dust was not ignited, whereas explosions varying in violence instantly followed the firing of the shots in the other 7 instances; the last trial of all produced the most violent explosion, which, in the official report, is described in the following words: "Dust was ignited, followed by a continuous roar and a rush of flame completely filling the shaft mouth and ascending 60 ft. into the air. This was the most violent explosion since the commencement of the experiments. It is difficult for anyone who did not witness this experiment to realize the extent of the explosion. The flame continued to issue from the pit for 5 or 6 sec., followed by dense smoke. The violence carried away some of the woodwork 37 ft. above the pit mouth (only one cannon was fired)."

Professor Galloway was present and witnessed this experiment, and at once expressed the opinion that all previous experiments were dwarfed to absolute nothingness; he was highly pleased to have himself seen his views, so long and perseveringly affirmed, verified in such a striking manner. On four different occasions during the experiments, the flame traveled 600 ft. and ceased only when it reached the mouth of the pit; there was an undoubted increase of violence as it traveled on its course.

The details of these tests, which are "historic," were in due course submitted to the authorities, and Henry Matthews, (now Lord Llandaff), at that time His Majesty's principal secretary of state, in a brief dated December, 1890, the year in which the Llanerch and Morfa explosions happened, refers to these experiments as follows: "As I felt the great importance of arriving at further information and more certain conclusions on this subject, I sanctioned the proposal of Mr. Hall, Her Majesty's inspector of mines, to conduct experiments for the purpose of ascertaining whether an explosion can be caused by blasting operations when coal dust is present, and in the entire absence of gas or firedamp."

"Mr. Hall has the merit of having been one of the first to draw attention to this subject. He, as well as Mr. Galloway, whose opinions are well known and have been often published, brought the matter prominently before the royal commission appointed in 1876 to report on accidents in mines, before whom, however, these opinions met only with partial acceptance. The subject has also been specially investigated in the Durham district by J. B. Atkinson and W. N. Atkinson, Her Majesty's inspectors of mines.

"The result of Mr. Hall's experiments is reported by him in a paper which accompanies this circular, and to which I desire to call most serious attention. The conclusion deduced by Mr. Hall from his experiments is, that a blown-out shot may, in the presence of coal dust, and in the entire absence of firedamp, cause explosions of great violence, often accompanied by volumes of rushing flame, traveling considerable distances, and possibly as far as the supply of coal dust continues."

In 1891, a royal commission on explosions from coal dust in mines was appointed. The members of that commission were the Right Hon. Joseph Chamberlain, M.P. (chairman), Lord Rayleigh, Sir William T. Lewis, Harold B. Dixon, Emerson Bainbridge and Charles Fenwick. At the instance and by the directions of this commission, I undertook to carry out a long series of experiments to test representative dusts from the various mining districts in Great Britain. With this object, samples were procured from 45 separate collieries and from 36 distinct seams; these samples were subjected to similar tests to those already described. This work occupied 12 days, the weather throughout being fine and warm and on several days there was an unusual difference between the wet and dry thermometers showing the atmosphere to be very dry.

The experiments were commenced on each day by firing a 2-lb. charge of gunpowder without dust, so that the onlookers might be better able to judge of the part played by the dust in the subsequent experiments. The conditions of the test were kept as nearly alike as possible for each sample, and on the completion of each test, blank shots were fired to clear the shaft of dust, before another sample was proceeded with. One hundred and three shots of gunpowder were fired, the charge in each case being 1½ lb.; 10 shots of roburite and 3 shots of ammonite were also fired, the weight of charge being 8 oz. More than 50 per cent. of the gunpowder shots resulted in violent explosions of dust, and where there was not an actual explosion, there was always considerable charring of the electric cable except in one or two instances, showing that the dust had ignited but was of such a nature or so impure that it could not develop into a veritable explosion. Of the 10 shots fired with roburite, and those with ammonite, there was neither any sign of an explosion of dust nor any charring. The fact that the "high explosives" behaved so differently to ordinary gunpowder is most important, and at once suggests a means of mitigating the danger of blasting in coal mines.

In reporting these experiments to the royal commission, the conclusions were summarized as follows:

"1. That coal dust from several seams in different districts, notably those from Glamorgan, Monmouth, Durham, Lancashire, Yorkshire and Scotland, are almost as sensitive to explosion as gunpowder itself.

"2. That coal dust is, as a rule more sensitive to explosion in proportion to its high quality and freedom from impurities.

"3. That a ready supply of oxygen, such as is supplied by a brisk ventilation, has the effect of making coal-dust explosions more probable and more severe.

"4. Of the whole of the dust tested, that from the Albion colliery, Glamorgan, excelled all others in violence and sensitiveness to explosion."

Note. Within a year from the date of this report, there occurred at the Albion colliery one of the most sweeping and disastrous explosions which has ever been recorded; 290 people were killed.

"5. With regard to precautionary measures to be taken in the face of these facts, I have again to urge the total abolition of gunpowder from coal mines and the substitution of certain high explosives."

The commissioners examined every one whom it was thought could throw any light on this subject. Among the witnesses were the late Sir Godfrey Lushington, the late Sir Frederick Abel and the leading mining engineers of the Kingdom.

The evidence was conflicting, but anyone who studies it carefully and impartially can hardly fail to be convinced that where dry coal dust is allowed to accumulate and be carried forward by the ventilation and traffic throughout the main arteries of a mine, a disaster of great magnitude may be developed either by a gunpowder shot blowing out, or by the accidental ignition of a small and otherwise harmless quantity of firedamp.

The Commissioners' Conclusions

The commissioners give a summary of their conclusions as follows:

"1. The danger of explosion in a mine in which gas exists even in very small quantities, is greatly increased by the presence of coal dust.

"2. A gas explosion in a fiery mine may be intensified and carried on indefinitely, by coal dust raised by the explosion itself.

"3. Coal dust alone, without the presence of any gas at all, may cause a dangerous explosion if ignited by a blown-out shot or other violent inflammation. To produce such a result, however, the conditions must be exceptional, and are likely to be produced only on rare occasions."

The last sentence in paragraph 3, rather weakens their conclusions and is calculated to throw great difficulty in the way of remedial measures; however, the following precautions which the commissioners suggest, especially No. 1, are definite and much to the purpose:

"1. That the firing of shots should be carried out between the shifts and when the majority of the men are out of the mine.

"2. Where general watering is not prescribed by the inspector, that the roads on either side of the place where a shot

is fired should be thoroughly wetted for a space of at least 30 yards.

"3. That large accumulations of dust, whether on the roof or floor, should not be allowed to remain."

These are the final words of the commissioners and it is curious that they make no mention of the desirability of substituting "high explosives" for gunpowder, although several witnesses spoke highly of these newer explosives. The commissioners do not appear to have given proper weight to the fact that these flameless explosives were already being used with success in several well conducted mines, a fact which nullified the adverse criticism of those who had no previous personal experience of their use.

After having made a study of all the great explosives, and being firmly impressed that blasting with gunpowder was the initial cause of nearly all these disasters, I became a strong advocate for the abolition of gunpowder. In a paper read before the Institution of Mining Engineers, I submitted figures showing the number of fatalities from so-called firedamp explosions, which were directly due to blasting with gunpowder. These figures were alarming, and were a serious indictment against the continued use of this explosive. The paper also gave statistics from actual practice showing the effect on cost of working and quality of production in collieries where "high explosives" had already taken the place of gunpowder.

By the opponents of the change, it was constantly argued that the use of the more rapid high explosives would entail a large increase in the amount of small coal or slack in consequence of its shattering effect. It was asserted that there would be as much as 10 per cent. more small coal produced, that the cost of each charge would be double that of gunpowder; there was also a constant repetition of the stock phrase, that legislation in the direction indicated, "would lead to many mines being closed." It would, of course, have been a serious matter if the new explosive were likely to damage the coal to the extent suggested, but from actual results obtained at different collieries, I was able to show that an increase of 2 per cent. of slack was nearer the actual figure than 10 per cent.

The paper here referred to was severely criticized, especially by north of England engineers and I was attacked by a section of the press in an unfriendly spirit; indeed there seemed to be an honest conviction that the abolition of gunpowder spelled almost ruin to the coal trade.

In 1896 the Coal Mine Regulation Act of 1887, was amended, and Section 1 of the amended act reads: "(1) the power to propose, and modify special rules for a mine under the Coal Mines Regulation Act of 1887 (in this act referred to as the principal act) shall include powers with respect to any of the following matters:

"(a) The nature and description of the lights or lamps to be used in the mine and their custody and the mode of using and trimming them, and

"(b) The description of explosives to be used in the mine, the mode of using and of storing such explosives, and of making and stemming holes, and the times at which and the manner in which shots are to be fired in the mine, and,

"(c) The number or class of persons, if any, to be permitted to remain in the mine or any part thereof while shots are being fired, and,

"(d) The watering or efficient damping of the mine or any ways or places therein, and,

"(e) Generally the precautions to be adopted for the prevention of accidents from inflammable gas and coal dust."

This extension of the power of the secretary of state was proposed by Sir William Harcourt—himself an ex-home secretary—and in due course the power thus conferred was taken advantage of to make an order to be called the "Explosives in Coal Mines Order." The following is the text of that order:

"Whereas by Section 6 of the Coal Mines Regulation Act, 1896, it is enacted that a secretary of state, on being satisfied that any explosive is, or is likely to become, dangerous, may by order, prohibit the use thereof in any mine or in any class of mines either absolutely or subject to conditions: I hereby, in pursuance of the power conferred on me by the aforesaid section, make the following order:

"1.—(a) In all coal mines in which inflammable gas has been found within the previous three months in such quantity as to be indicative of danger, no explosive, other than a permitted explosive as hereinafter defined, shall be used in or taken for the purpose of use into the seam or seams in which the gas has been found, or any shaft or drift communicating therewith which is in process of being deepened or sunk or being driven, as the case may be.

"(b) In all coal mines which are not naturally wet throughout, no explosive, other than a permitted explosive as hereinafter defined, shall be used in or taken for the purpose of use into any road or any dry and dusty part of the mine, or any shaft or drift communicating therewith which is in process of being deepened or sunk or being driven, as the case may be.

"2. In all such coal mines or parts thereof as aforesaid, the use of permitted explosives is prohibited unless the following conditions are observed:

"(a) Every charge shall be fired by a competent person (hereinafter called the shot-firer) appointed in writing for this duty by the owner, agent, or manager of the mine, and not being a person whose wages depend on the amount of mineral to be gotten.

"(b) Every charge of the explosive shall be placed in a properly drilled shot hole and shall have sufficient stemming, and each such charge shall consist of a cartridge or cartridges of not more than one description of explosive.

"(c) No cartridge shall be used unless it is marked in the manner set forth in the third schedule hereto, in addition to any marking required by the first schedule hereto.

"(d) No charge shall be fired except by means of an efficient electrical apparatus so inclosed as to afford reasonable security against the ignition of inflammable gas, or by a permitted igniter-fuze, as hereinafter defined.

"(e) Where the charge is fired by an electrical apparatus, the shot-firer shall not use a cable for the purpose, which is less than 20 yd. in length. He shall himself couple up the cable to the charge and shall do so before coupling the cable to the firing apparatus. He shall also himself couple the cable to the firing apparatus. Before doing so, he shall see that all persons in the vicinity have taken proper shelter. Should the charge miss fire, he shall immediately disconnect the cable from the firing apparatus.

"(f) Every electrical firing apparatus shall be provided with a removable handle or safety plug, or push button, which shall not be placed in position or operated until the shot is required to be fired and which shall be removed or released as soon as a shot has been fired. The removable handle or safety plug shall at all times remain in the personal custody of the shot-firer while on duty.

"(g) Each explosive shall be used in the manner and subject to the conditions prescribed in the schedules hereto.

"(h) Where two or more shots are being fired in the same place and such shots are not fired simultaneously, the shot-firer shall make an examination for gas immediately before the firing of each shot, and shall not fire the shot unless he finds the place where the shot is to be fired and all contiguous accessible places within 20 yd. free from gas and safe for firing.

"Provided that nothing in this order shall prohibit the use of a safety fuse in any mine in which inflammable gas has not been found within the previous three months in such quantity as to be indicative of danger.

"3. In every coal mine the use of any explosive is prohibited in the main haulage roads and in the intakes unless all workmen have been removed from the seam in which the shot is to be fired, and from all seams communicating with the shaft on the same level, except the men engaged in firing the shot, and in addition such other persons not exceeding 10 in number as are necessarily employed in attending to the ventilating furnaces, steam

boilers, engines, machinery, winding apparatus, signals, or horses, or in inspecting the mine; or unless a permitted explosive is used under the conditions prescribed in Section 2 of this order, and every part of the roof, floor, and sides of the main haulage road or intake, within a distance of 20 yd. from the place where it is used, is, at the time of firing, thoroughly wet, either naturally or from the application of water thereto.

"This section shall not apply to such portions of the main haulage roads and intakes as are within 100 yd. of the coal face.

"This section shall not authorize the use of any explosive in any case where the use of such explosive is prohibited by Sections 1 or 2 of this order.

"4. Detonators shall not be used in or taken for the purpose of use into any mine unless the following conditions are observed:

"(a) Detonators shall be under the control of the owner, agent, or manager of the mine, or some person or persons specially appointed in writing by the owner, agent, or manager for the purpose, and shall be issued only to shot-firers or other persons specially authorized by the owner, agent, or manager, in writing.

"(b) Shot-firers and other authorized persons shall keep all detonators issued to them until about to be used, in a securely locked case or box, separate from any other explosive.

"In the case of a shaft being sunk from the surface, it shall not be deemed a contravention of this section if the primers for charges are fitted with detonators on the surface before being taken into the shaft, provided the primers are so fitted in a workshop established under Section 47 of the Explosives Act, 1875, and are only taken into the shaft immediately before use by the shot-firer or other authorized person, and in a thick felt bag or other receptacle sufficient to protect them from shock.

"5. Sections 1, 2 and 3 of this order shall not apply to mines of clay, or stratified or nodular ironstone, nor shall they apply to shafts in course of being sunk from the surface, or deepened, or to drifts and other outlets being driven from the surface, except as provided by Section 1 of the order.

"Where a mine contains several separate seams, this order shall apply to each seam as if it were a separate mine.

"6. In this order, the term "permitted explosives" means such explosives as are named and defined in the first schedule hereto, and the term "permitted igniter-fuse" means such igniter-fuses as are named and defined in the second schedule hereto; provided that where the composition, quality or character of any explosive or any igniter-fuse is defined in such schedule, any article alleged to be such explosive or such igniter-fuse which differs therefrom in composition, quality or character, whether by reason of deterioration or otherwise, shall not be deemed to be the explosive or igniter-fuse so defined; provided further that an owner, agent or manager shall not be responsible for the composition, quality or character of an explosive or igniter-fuse, if he shows that he has in good faith obtained a written certificate from the maker of the explosive or igniter-fuse that it complies with the terms of the schedule, and that he has taken all reasonable means to prevent deterioration of the explosive or igniter-fuse while stored."

This is the position as it is today. The order makes it illegal to use any explosive other than a "permitted explosive" in mines coming within the category of fiery, or dry and dusty. A permitted explosive is one which has passed the official test at Woolwich arsenal. The conditions of these official tests are similar to those laid down in a proposal which has recently been submitted to the American authorities. Gunpowder has entirely failed to pass the tests and hence it is no longer used in mines to which the Explosives in Mines order applies.

Legislation Has Proved Beneficial

This legislation has proved beneficial beyond all expectation. The order first came into force in 1897 and we find the average annual loss of life from explosions since that date to be 50 per cent. fewer than was the case in a similar period immediately preceding its operation. I believe that this great diminution in fatalities from explosions has been chiefly due to the fact that the use of gunpowder which always entailed a constant risk of blown-out shots, has been largely dispensed with.

The interference with the economic position has been trifling and the present users of the "high explosives" have now no cause to regret the change; in fact, for much of the work underground, experience has shown the newer explosives are more economical than the old.

In conclusion, it is perhaps well to remind the workers in mines that all the labors of scientific experts will prove of no avail to avoid disaster unless they themselves are willing to submit to strict discipline and cheerfully comply with the regulations made for their safety, and also to remind the higher authorities in whose hands the administration of the law rests, that without their sympathy and support, it is impossible for mine officials to adequately control large bodies of men.

Prospecting for antimony ores, among which stibnite, the sulphide of antimony, is most prominent, has been carried on (*Chem. Trade Journ.*, April 24, 1909) in South Burma, and in Lahaul, where a large deposit occurs near the Shigri glacier. Stibnite seems to be widely distributed in the Tenasserin division of South Burma.

The Bottineau Gas Field

By John G. Barry*

During the last year and a half several discoveries of natural gas in Bottineau county and eastern Ward county have caused considerable excitement. The first discovery was made at the Parker farm about 9½ miles south of Westhope on July 3, 1907, when gas was struck at 178 ft., while drilling a well for water. Since that time many wells have been drilled for gas in the same region and a number of them have been successful. Accordingly a preliminary investigation of the region was made early in September, 1908. The time possible for this work was very limited, and only the main facts in regard to the field were obtained.

The wells drilled in the vicinity of the Parker farm pass through the glacial covering and cut a gas-bearing sand at depths ranging from 154 to 176 ft. Four wells at this place have shown good flows of gas, while three others drilled to the north toward Westhope have been unsuccessful. A pressure exceeding 100 lb. per sq.in. and a flow of 2,000,000 cu.ft. per day is reported for each of the successful wells. The Great Northern Oil, Gas and Pipe Line Company, which has been carrying on prospecting at the Parker farm, has drilled a deep well in hope of striking a deep-seated body of gas. At the time of the visit to this region this well had reached a depth of 1180 ft. On Sept. 11, 1908, this well showed the following section:

Soil, 2 ft.; yellow clay and gravel, 30; Blue clay, 122; gravel with sand below (no flow of gas), 16; white slate, 35; black sand (seam), 3; soft blue shale (caving), 242; black slate, 50; blue shale (caving), 205; yellow hard rock (limestone), 5 in.; blue shale, 145 ft.; sandy shale, 10; blue shale to bottom, 320; total, 1180 feet. Oil seepage is reported in the common wells of this vicinity, but this is probably due to decomposing organic matter in the drift.

At Mohall there are two wells which have yielded gas. They are about 7 miles west and north of the town, and about 26 miles west of the wells at Westhope. A generalized section of these wells was as follows: Yellow clay, 20 to 25 ft.; blue clay, 200; blue shale, 70 to 80 feet.

Since the visit to this region gas has been reported as having been struck at the following places: Maxbass, 16 miles southwest of Westhope; Lansford, 10 miles southeast of Mohall; and at the McCaslin farm, 14 miles southwest of Mohall, and five miles west of the Parker farm, at a depth of 200 ft. The sand in which the gas is found varies in thickness in most cases from 16 to 20 ft. It is med-

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ium fine grained, rounded, and of a greenish-black color due to an admixture of decomposing carbonaceous matter.

An analysis of the gas made by Prof. E. J. Babcock, of the School of the Mines of the University of North Dakota, shows the following results: Hydrogen, 0.5 per cent.; methane, 82.7; ethylene and other illuminants, 0.2; carbon monoxide, 1.2; oxygen, 3; nitrogen, 12.4 per cent. B.t.u. (calculated), 886 per cubic foot. The oxygen and nitrogen were probably from air present.

It is impossible at present to definitely outline the posibilities of the area. The gas is now being used locally in farm houses and it is proposed to pipe it to Westhope for use there, and later to some of the other surrounding towns.

Most of the wells of this area which have been productive are situated within the area of Glacial Lake Souris, the gas occurring in a layer of sand immediately underlying the glacial drift. Upon the recession of the ice-sheet from the Coteau du Missouri a glacial lake known as Glacial Lake Souris was formed, lying between the coteau and the southern border of the ice sheet.[1] Considering Upham, McHenry county, the Coteau du Missouri lies about 50 miles to the southwest and runs in a northwest-southeasterly direction. The Turtle mountains lie about 25 miles to the northeast of Upham. Both the Coteau du Missouri and the Turtle mountains have a considerably greater altitude than the region under consideration. Undoubtedly the coteau and the mountains were at one time continuous, and their present relationship is due to erosion.

It is universally thought that the erosive action of the ice sheet was limited to wearing down the smaller elevations and partly filling the pre-existing valleys with its débris. Considering the course of the Coteau du Missouri, and the Souris and Sheyenne rivers, it is reasonable to suppose that previous to glacial time there lay to the north and east of the coteau a principal drainage area which had a northwest-southeast course, and which probably drained to the south and east. It is certainly reasonable to suppose that there was deposited throughout the region a considerable amount of detrital material with an admixture of organic matter, probably of vegetable origin. Upon the decomposition of the organic matter the débris would act as an excellent gas reservoir. This theory as to the origin of the gas occurrence of this region is put forward with only a slight knowledge of the existing facts, and is only a preliminary one, conditioned by the gathering of additional data.

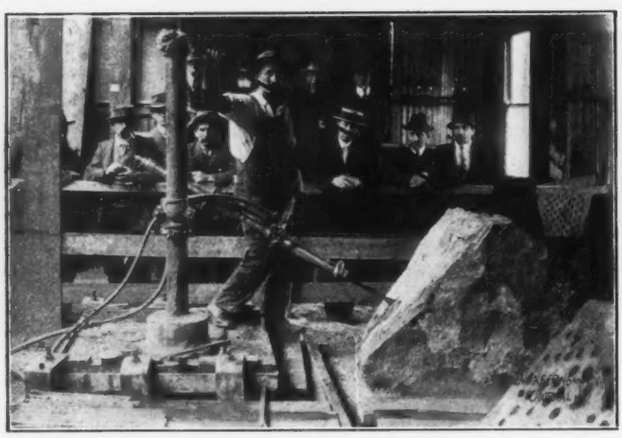
[1]Upham, Monograph XXV., U. S. Geological Survey, p. 267.

Rand Stope Drill Competition

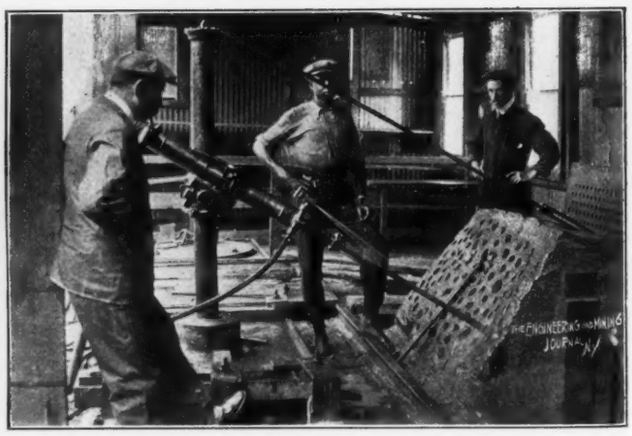
The photographs reproduced herewith show several of the drills entered in the Rand stope drill competition. These are of interest in connection with the article "Surface Trials in Rand Stope Drill Competition," by Eustace M. Weston, in the JOURNAL of May 15, 1909, p. 998.

SISKOL DRILL

CHERSEN DRILL



WAUGH DRILL



KONOMAX DRILL

According to the statistics collected for THE MINERAL INDUSTRY, the production of arsenious acid increased from 2,020,000 lb., valued at $101,000, in 1907, to 2,603,505 lb., valued at $99,193, in 1908.

Salt in Austria

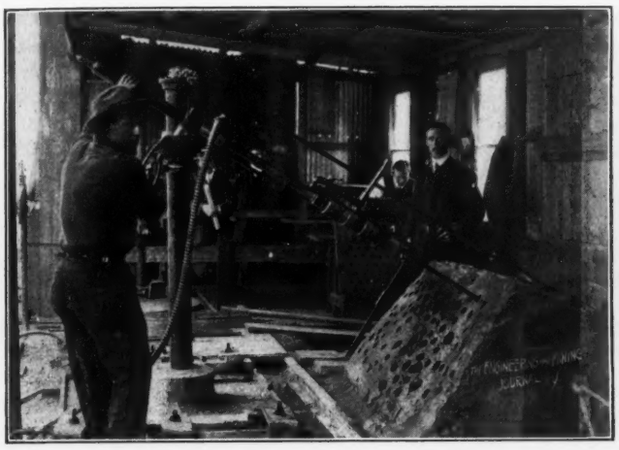
The salt deposits of Austria are extensive, says Consul-General W. A. Rublee, of Vienna. There are very large mines in Galicia near Cracow, at Wieliczka, and these furnish 36 per cent. of the salt Austria produces. Until a year ago the salt in Galicia was mined, but now the easier method of artificially producing brine by introducing water into the mines has been largely adopted. This brine is then evaporated in open pans, in vats and by the vacuum process.

The value of the salt at the source of production, whether mined or manufactured, ranges per 100 kg. (220 lb.) from 1.04 to 2.25 crowns (21 to 45c.), at which price it is sold by the government, salt being a government monopoly, to industrial concerns. This is exclusive of the cost of freight and packing. Other purchasers have to pay the tax levied on salt by the government, which varies in the different crown lands and ranges per 100 kg. from 14 to 20 crowns ($2.40 to $4). The average price, therefore, per 100 kg. is about 22.5 crowns ($4.50). The annual consumption of salt is estimated at 6½ kg. per capita (14.3 lb.). The salt from Galicia and Moravia is sent to Russia under contract.

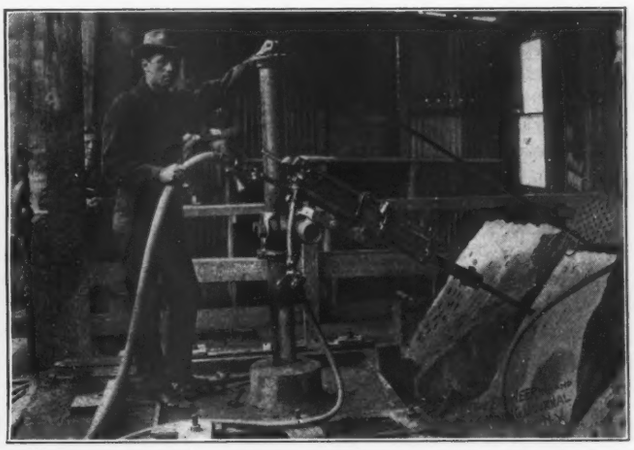
Amendment to Norwegian Mining Law

The text of the bill to be laid before the Norwegian Storthing for amending the law relating to mining and water-power concessions prescribes that all companies acquiring such concessions shall be domiciled in the country and governed by a majority of Norwegian citizens. Concessions are to be granted for terms of not less than 40 years, or more than 80 years, the property then being handed over to the state, together with any water-power plant that may be thereon. The purposes for which water-power concessions are to be used must be stipulated in the concession, and the right to prohibit the application of the water power to certain purposes is to be reserved. Work on the lands granted under concession must be commenced within a certain time, and preference is to be given to Norwegian labor and materials in carrying out the work.

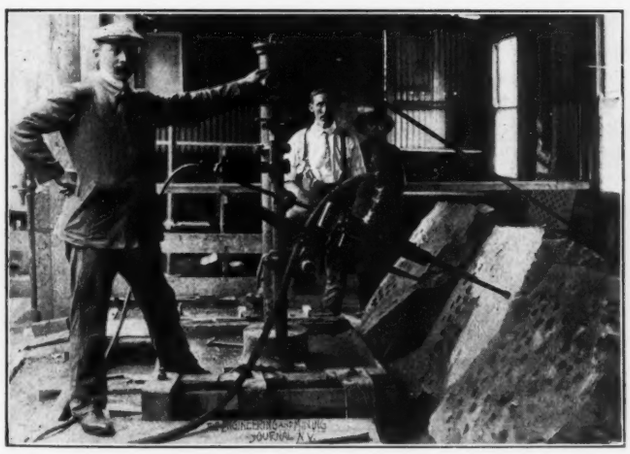
The concessionaires may not, without special permission of the authorities, enter into any agreement or combination for raising the price of mining products or electrical energy to Norwegian consumers. A communal tax, equivalent to 5 per cent. of the water power, and a production tax of 1 to 3 per cent. of the value of ore at the mine, will be charged. Mines must be worked in a proper manner, and not to the detriment of the community. In the event of the fines for infractions of the terms of the concessions increasing to a certain extent, the concession shall be forfeited to the state.



MURPHY DRILL



ANDERSON DRILL



WESTFALIA DRILL

VLOTTMANN DRILL

To prevent the formation of rust in boilers (*Petroleum Review*, April 24, 1909) experiments have been made at the Berlin Technical Institute, to use water deprived of the air it contains by means of charcoal. The decrease of rust in the boilers fed with water treated by the process has been about 25 per cent.

Tin Mining and Milling in North Queensland

The Tin-bearing Country Embraces 12,000 Square Miles; the Adoption of Modern Methods Will Render Available Much Low-grade Material

BY G. W. WILLIAMS*

The tinfields of North Queensland are found in the mountainous country that lies back of the coastal ranges from the port of Geraldton to Port Douglas. The hills composing the range vary in hight from 2000 to 4000 ft. and form the watershed from which the Tate, Walsh and Herbert rivers flow to the Gulf of Carpentaria. The tin-bearing country embraces an area of 12,000 square miles. The district is tapped by two railways, the Stannary Hill-Irvinebank line from Boonmoo (82 miles from Cairns on the Chillagoe line) and by the Mount Garnet tramway which branches off the Chillagoe line at Lappa and runs back to the Smiths Creek mines. The Koorboora field lies on the Chillagoe line and forms the most westerly portion of the fields.

Wolfram, molybdenite and scheelite occur throughout the district, often in intimate association with the tin. The underlying rock of the whole area is granite which has been exposed by denudation in many places and which occasionally sends dikes into the overlying sedimentary rocks. Generally speaking, the tin lodes are composed of holocrystalline chlorite occurring in lenses or irregular bunches in the metamorphosed sedimentary rocks. Topaz, tourmaline and fluorspar are normal accessory constituents of the lodes, together with iron pyrites, wolfram and occasionally copper and bismuth. In some cases there is distinct evidence of the secondary enrichment of the lodes at the surface, but in most cases the mines do not show any marked fall in grade with depth. In one mine, I obtained some interesting tin crystals where the cassiterite was obviously a pseudomorph on tourmaline. Hundreds of small lodes have been worked throughout the whole area but in nearly every case ore of less than 2 per cent. has not been taken. With the exception of the mines owned by the Stannary Hill Company, North Queensland tin mining is controlled by John Moffat of Irvinebank, who has erected tin-dressing plants throughout the district and who owns in part or in entirety almost every mine. It was due solely to Mr. Moffat's enterprise that the Chillagoe, Mount Garnet and Mount Molloy mines were opened up.

The most important mine on the field is the Vulcan at Irvinebank. This mine is developed down to 1050 ft., at which depth the lode is 100 ft. in length and 24 ft. wide, the ore averaging 7 per cent. tin. As depth has been gained the ore has shown little change, but the orebody is distinctly smaller in depth. It is worked by large underhand stopes and not a stick of timber or a ton of filling is used. The great vaulted stopes are open from the top of the mine to the bottom.

About four miles distant is the Governor Norman, a large low-grade mine. Up to date the low-grade (1 per cent.) mines have not been seriously attacked, except by the Stannary Hill company, but wherever I went I saw evidences of the existence of large areas of 2-per cent. ore. Under the present system of mining the lodes are worked only in the richer portion. Mining methods are archaic and in the matter of transport of ore both in the mine and on the surface the methods in vogue are barbaric in their simplicity. Costs must be appallingly high, for mines I visited that had been producing good ore for 10 years were still handling their ore by horse-whims up narrow underlay shafts of irregular grade.

The tin-dressing plants erected by the Irvinebank Mining Company (Mr. Moffat's firm), are uptodate and do good work. At Irvinebank the plant comprises a 60-head battery with jigs, vanners and buddles. A tin smelter is attached and smelts concentrate and stream tin from the various dressing plants and river workings.

As will be seen when the work done by the Stannary Hills company is considered, the treatment of low-grade ore has met with some success. It is quite certain that with modern methods, modern plants and improved facilities for transport the 1.5 per cent.-lodes will prove highly payable.

The Stannary Hill Company

The leases owned by this company extend along the crest of a range of country the backbone of which appears to be composed of low-grade tin-bearing chlorite. There are several mines of which the most important are the Ivandoe, Kitchener and Extended. In the former mine the ore occurs in stringers and bunches in chlorite. These bunches make and cut out with little warning and are often of large extent. At 250 ft. depth the ore made into a bunch that measured 220 by 50 by 20 ft., and after cutting out entirely another bunch of ore, was again picked up at 350 ft., measuring 120 by 10 by 50 ft. These bunches are worked out without timber. In some cases, where the deposit is long and comparatively narrow, the stopes have been carried up to 159 ft. in hight without timber or filling. Throughout the whole district the country rock hangs perfectly and falls are almost unknown.

An adit level 2500 ft. in length has been driven under the line of leases. From this level it is proposed to prospect for ore with a diamond drill. The country is admirably suited for this kind of development work The bunches follow a well marked shoot in the surrounding country. The ore shoot has been followed down to 700 ft. below datum and at present the shaft is being sunk with a view to opening up below that point. The ore averages 2 per cent. On the Kitchener mine a similar deposit has been worked, and the ore appears to be pitching into the ore shoot of the Ivandoe mine. On the Extended the crest of the hill is composed of low-grade ore (1 per cent. tin stone). It is the intention of the management to build a battery close to the hill and to open up a large open cut. There is little doubt that the venture will be entirely successful. At the Arbouin mine, about four miles distant from the Stannary Hill station, ore containing 1 per cent. tin stone was successfully treated by open cutting. Breaking cost 48c. and haulage and development 50c. (Transport involved crossing a valley by aërial tram and three miles of railway.) Crushing cost $1.60 per ton, making the total $2.58 per ton (2240 lb.)

The Arbouin Mill

The tin-dressing mill is situated on the side of the river about seven miles away from the mine, with which it is connected by the tramway. The trucks of ore are run down a steep incline and dumped into the bins, from which the ore passes over a 2½-in. Blake-Marsden ore breaker. A 1-in. grizzly receives the product and the oversize is returned by an elevator to a smaller breaker of the same type which reduces it to 1-in. cubes.

The product from the second breakers and the undersize from the grizzlies pass to the battery bins from which it is fed by means of Challenge feeders to 30 head of stamps. The latter weigh 1350 lb. and run at 104 drops per minute, with a 6-in. drop. The screen is woven, 121 mesh. The mill pulp passes to hydraulic

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classifiers which separate the slimes and feed the sands to two 5-hutch jigs. The first heads, which contain about 25 per cent. of tin, go to the calciners. The product from the four other hutches in each jig passes to a conical classifier which delivers the overflow to two, and the underflow to three Wilfley tables. The middlings from all five tables pass over another table and the middlings from this table are returned to the same table. The concentrates from all the tables go to the calciners; the tailings are discharged to the river and the slimes pass to the settlers.

The concentrates from all sources are collected in settling pits and are removed from these to a drier heated by the waste furnace gases. The calciner is a three-hearth Merton furnace with extended forehearth. The roaster treats 120 long tons per week. The roasted concentrates are mixed with water and pumped up to three 4½-ft. grinding pans. The pulp from the pans is distributed over four double-belt Luhrig vanners. The clean concentrate contains 70 per cent. tin oxide. The rest of the product is pumped up to two grinding pans and from these is distributed by classifiers to two double-belt Krupp-Luhrig vanners. The concentrates are sent to the keiving tubs, the middlings are returned and the slimes and tails pass over three revolving buddles. These buddles also receive the slimes from the settlers. The concentrates from these buddles are returned to the calciners. The tails go out to the race. Gradings showing the nature of the battery pulp and the final tails, with the battery crushing through 225-mesh screen and no regrinding, are shown in an accompanying table. The ore consisted of 160 tons from the Kitchener mine (3 per cent. SnO_2), 984 tons from Ivanhoe (2.90), and 1941 tons from Arbouin (1.4), a total of 3085 tons of 2.001 per cent. ore. Samples were screened dry; 15-mesh screens were used on the battery boxes. Stamp duty was 5.4 tons per 24 hours. Slimes in the product through 100 mesh carried a trace of SnO_2.

Since the installation of grinding pans, sizing tests have not been made, but the recovery is approximately 90 per cent. on 2-per cent. ore.

It is most probable that the battery will be rebuilt on the side of the big mill at the Extended mine. A saving of 55c. per ton in transport will be effected when the alteration is complete and a better arrangement of the concentration plant will also effect a slight reduction in costs.

The Koorboora Tinfield

Koorboora, 108 miles from Cairns on the Chillagoe railway, is the center of a small but valuable group of tin mines. The Irvinebank Mining Company has a 10-head tin-dressing plant here for the purpose of treating ore from its mines and from the mines worked by tributers and prospectors in the district. The battery was erected nine years ago, and since then it has treated 40,000 tons of ore, obtaining 2200 tons of concentrates. The mines are situated within a radius of 4½ miles of the mill. The most promising is the Shakespeare mine, situated about ¼ mile from the mill. The lode has been opened up in an open-cut to 50 ft. in depth and is exposed for 80 ft. in length and 25 ft. in width. The main shaft is down 200 ft. and a large tonnage of 1- to 1.5-per cent. ore has been opened up. Under present conditions it does not pay to treat ore containing less than 1.75 per cent. tin stone. This mine is a good example of a mine which, if systematically opened up and connected by aërial tram with the battery, could make 1.5 per cent. ore pay with tin at $650 per ton. The lode is massive chlorite somewhat irregular in outline but maintaining uniform metal content. The country rocks are greywackes and other altered sedimentary rocks.

The Southwick mine produces 10-per cent. ore from a narrow lode. The lode has been followed down to 200 ft. in depth by an underlay shaft which, like most North Queensland shafts, reproduces with faithful accuracy every variation in the dip of the lode. The ore is raised by horses. At the Tennyson group there is a large tin-bearing chlorite formation, but only the rich bunches in the lode are worked. At 120 ft. the ore averages 5 per cent. lead, 3 per cent. tin oxide, 8.5 per cent. zinc and 17 oz. of silver per ton. There is the making of another fair-sized mine in these leases.

Throughout the district, I visited many small mines where small lodes or bunches of rich ore in low-grade orebodies were being worked with horse-whims. The Neville mine is of interest in that it is, I think, the largest wolfram mine in the world. The leases are situated about 1½ miles from the battery. The lode is a large chlorite body the limits of which have not been clearly defined. At 200 ft. the pay ore measures 150 ft. in length and averages 20 ft. in width. To date 8100 tons have been crushed for a return of 6.6 per cent. wolfram (70 per cent.). The mine was under water at the time of my visit, but owing to an increase in the price of tungsten it was being unwatered with a view to the restarting of stoping. This mine has a good vertical shaft and has been well developed.

Near the Neville is the Telegraph lease where a lode 50 ft. in length and 8 ft. wide is worked. The ore carries 4 per cent. each of tin and wolfram. In almost all mines in the tin country the ore is hand-picked in the stopes, the richer portions only being sent to the surface. Miners receive from $2.16 to $2.40 per 8-hour shift. In development work the "leading hand," who receives an extra 25c. per day, crushes and pans off his own samples.

The Tate River Alluvial Workings

The Tate river rises in the coastal ranges and flows westward to the Gulf of Carpentaria. The river gravels have been worked since 1876. The present company, an offshoot of the Irvinebank company, acquired its property in 1899, and since then has sluiced 175,000 tons of dirt for a return of 430 tons stream tin. The tin from these workings is exceptionally pure and the average value of the dressed tin stone is 74 per cent. metallic tin.

During the winter months the gravel is piled up at the head of large sluiceways and when the summer rains commence water is brought in by a race 7½ miles in length and the accumulated dirt washed down to the races where the tin is collected. The gravels are about 600 yd. wide and vary in depth from 1 to 15 ft. The company owns 103 acres of alluvial ground. The gravels average 5½ lb. of dressed tin per ton.

Wolfram Camp

This camp is situated about 14 miles from Dimbulah, 73 miles from Cairns on the Chillagoe railway. The ground is held in miners' claims, leases not being allowed. The geology of the district is similar to that of the rest of the tin country, altered sedimentary rocks overlying the granites. The wolfram occurs

SIZING ANALYSES, MAY, 1906.

	Battery Pulp.			Final Tails.		
	Per Cent. Weight.	Per Cent. SnO_2.	Per Cent. of Total SnO_2.	Per Cent. Weight.	Per Cent. SnO_2.	Per Cent. of Total SnO_2.
On 20 mesh	0.63	1.6	0.4	0.08	0.36	0.07
Through 20 on 30 mesh	7.93	1.6	5.5	3.75	0.36	3.24
Through 30 on 40 mesh	7.23	1.7	5.3	5.25	0.40	4.7
Through 40 on 60 mesh	16.08	1.8	12.7	14.93	0.32	10.7
Through 60 on 80 mesh	8.40	2.2	7.9	6.35	0.30	5.7
Through 80 on 100 mesh	9.31	2.7	10.9	10.31	0.26	6.2
Through 100 mesh, coarse	30.25	2.5	57.3	34.10	0.54	9.4
Through 100 mesh, slimes	20.17		7.0	22.74		7.0
		2.4			0.43	

in small chlorite lodes which average 10 ft. in length and 2 ft. in width. Some larger shoots extend to 30 ft. in length and 5 ft. in width. The ore is mostly won by miners working their own ground, but in some cases claims have been amalgamated and are worked from one shaft. The deepest shaft is down 300 ft. and in depth the mineral contents appear to be practically unchanged. Generally speaking the lodes average 5 per cent. of wolfram and molybdenite. A dressing plant has been installed by the Irvinebank company. The plant comprises rolls, jigs, vanners and an oil flotation process for the recovery of molybdenite. The latter yields a 90-per cent. to 95-per cent. concentrate. The wolfram concentrate from the jigs and vanners contains 50 per cent. tungstic acid and 10 per cent. bismuth. With a good market for wolfram the district employs from 400 to 500 men, most of whom can make good money from their claims.

Conclusions

Reviewing these notes, made as a result of a fortnight spent in riding around the chief centers of the tinfields, I can only repeat the remark made frequently in connection with individual mines: the future of the field lies in the development and working of the low-grade lodes. It is a pity to see the rich portions of a lode stripped out while 1.5 per cent. ore is left in such a position that it can never be profitably recovered. The Stannary Hills company has demonstrated at its Arbouin mine that low-grade ore can be profitably treated even with high milling and transport costs. It remains now for the other tin mines to adopt modern methods and to realize that 1 per cent. tin ore is an extremely valuable asset and should not be thrown aside or buried in old stopes for want of better filling.

Of course there are mines that from their situation, can never hope to mine low-grade ore, but these mines are in the minority; the bulk of mines should be able to work on ore of far lower grade than that which is now considered unpayable.

The value of the mineral production of Queensland during 1908 (*Queensland Gov. Min. Journ.*, April 15, 1909) was £3,844,487, a decrease of £287,677, as compared with 1907. The deficiency was due to the lower value of minerals other than gold.

It is stated in the fourteenth annual report of the Rand Mines, that the ore reserves at the end of 1908 were: Main reef, 2,475,215 tons; Main reef leader, 3,666,556 tons, and South reef, 4,562,061 tons, making a total of 10,703,832 tons.

Mineral Production of French Colonies

Special Correspondence

The Minister of Colonies has just issued the statistics of the mineral production of the French Colonies (Algeria and Tunis excepted) for the year 1907. The colonies referred to in the statistics include French Guiana, West Africa, Madasgascar, Indo-China and New Caledonia. The values of the products for each of the principal colonies are as follows:

Guiana (gold)	$2,246,419
New Caledonia (nickel, cobalt, chrome ores)	936,294
Madagascar (gold and iron ore)	1,858,865
Indo-China (gold, tin, zinc, tungsten, coal)	897,731
West Africa (gold)	22,550
Total	$5,961,859

The quantities and values of the different mineral products are given in the following table, the weights being in metric tons with the exception of gold, which is given in kilograms:

Gold	7,201 kkg.	$4,065,878
Nickel ores	120,106 tons	600,532
Cobalt ores	3,800 tons	112,125
Tin and tungsten	128 tons	59,700
Zinc	6,020 tons	131,200
Chrome ore	29,818 tons	223,637
Coal	305,156 tons	637,528
Lignite	15,062 tons	29,371
Sundries	3,335 tons	22,033
Total	483,425 tons	$5,882,004

Gold is obtained from placer workings and dredgings in Guinana, Madagascar, West Africa and Indo-China. The production of Guiana was 4160 kg. against 3503 kg. in 1906, declared for a value of 11,232,097 fr.; of Madagascar, 2940 kg. against 2200 in 1906; the balance came from Indo-China and West Africa.

The nickel ore (garnierite), a product of New Caledonia, shows a small increase, but the export is lessening with 103,542 tons, as against 130,688 in 1906. It will be noticed that the quantity of garnierite shipped in the last four years for which figures are available is greater than the ore produced, 458,175 tons being exported against 432,666 produced. It seems that the stocks on hand and the general business depression has brought about unfortunate conditions for the mining industry in New Caledonia. Great hopes are, therefore, directed to the metallurgical plants that are contemplated and under construction (Tao works). The export of chrome in 1907 from New Caledonia, was made by Birch & Co., Ltd., of London, in acordance with their agreement with the Société le Chrôme. This has terminated, however, and the rich Tiebaghi mine has been closed.

Some new companies are now working for gold in Guiana and Madagascar, phosphate rocks in the Touamotou Islands in the Pacific, and copper in New Caledonia, but they are not yet producing. The mineral output of the French colonies in 1907 was produced from 950 concessions of 587,367 hectares, 9664 men being employed. It should be noted that the production of the most extensively mineralized and worked region of the French Empire, Algeria and Tunis, is not included in the above statistics.

Henry H. Rogers

Henry H. Rogers, whose death was briefly noted in the Journal last week, died suddenly in New York, May 19, aged 69 years. He was born in Fairhaven, Mass., and began life in rather a humble way, like most boys of his time and place. When about 20 years old he was attracted to Pennsylvania by the new oil discoveries and entered into business there. A few years later he came into contact with John D. Rockefeller and some others of the founders of the Standard Oil Company, and entered into close business relations with them, which ended only with his death. He soon became prominent in the direction of the Standard, and was for many years its vice-president, being practically the chief manager after John D. Rockefeller retired from the more active management; in which, however, Mr. Rogers always had an active and prominent part.

As he accumulated money, he gradually became, outside of the Standard, a prominent figure in the stock markets, and a large owner of railroads and other securities. To him it was generally believed, was due the direction of the speculations of the "Standard Oil Group," which had so great an effect on Wall Street and which gave the group such a wide-spread influence on the railroad systems of the country.

About 10 years ago his attention was turned to copper, and he organized the Amalgamated Copper Company. Probably, as was generally believed at the time, the purpose was to control and centralize the copper production and business of the country, as oil had been controlled—though this purpose was not avowed. The course of the Amalgamated is a matter of history. Under Mr. Rogers' leadership it has, at any rate, become one of the great industrial institutions of the country, with an organization and technical management which is a model for similar corporations.

Mr. Rogers' latest work was in connection with the development of bituminous coal interests. He built the Virginian Railway, intended to develop certain sections of West Virginia and to furnish the coal mines of that State with a new outlet to tidewater. He furnished almost all the money for this enterprise, and had plans for its extensive development, and for giving it a leading place in the eastern bituminous trade.

Two years ago Mr. Rogers had an apoplectic stroke, and after that began to withdraw from his large speculative ventures, though he retained his active interest in the Virginian Railway. It was

due to this that his death caused so little sensation on the stock markets. It has been said that he felt keenly the bitter attacks on the Standard Oil monopoly and on other activities in which he was concerned; but he never gave any outward sign of such feeling.

Personally he was much esteemed by his intimates; and he gave generously to the town of Fairhaven, where he was born, and where he retained a residence all his life.

A Memorial to Bennett H. Brough

At the time of the death of Bennett H. Brough, last October, well and widely known as an instructor in the Royal School of Mines and in other technical institutions, and for many years as secretary of the Iron and Steel Institute, it was noted that he had left only a scanty provision for his family. When this was ascertained, the members of the Iron and Steel Institute raised a fund for the assistance of his widow and children. The response was a liberal one, and this fund is now practically closed. Aside and apart from this, many of Brough's friends, and particularly those who had no opportunity of subscribing to the above fund, have expressed a desire to establish a lasting memorial which, it is suggested, should take the form of a scholarship for boys from the City of London School, where he was educated, tenable at the Royal School of Mines, where, both as student and teacher, he did such excellent work.

A committee has been formed having as secretary George T. Holloway, and as treasurer R. E. Commans, Speer Road, Thames Ditton, Surrey, England, to whom contributions may be sent.

Mr. Brough occupied for a long time positions which brought him in contact with many people, who quickly learned to appreciate his many admirable qualities. Many of them, not only his English associates, but also American and foreign engineers, will be ready to contribute to what seems to be a fitting memorial.

A Proposed Powell Memorial

The 60th Congress appropriated $5000 for the erection of a suitable memorial to Maj. J. W. Powell, to be placed on the brink of the Grand Cañon of the Colorado. For the purpose of complying with the will of Congress the Secretary of the Interior asked W. H. Holmes, C. D. Walcott and H. C. Rizer to act as a committee to assist him in determining the character of the monument and in selecting the site.

At the earnest solicitation of numerous old-time associates of Major Powell, this committee has consented to initiate a movement among his friends for the erection of an appropriate monument over his grave at Arlington National Cemetery, which remains as yet unmarked. This project will undoubtedly appeal not only to the personal friends of Major Powell, but to large numbers of those who appreciate his achievements in the several branches of science to which he so largely contributed.

The various statues in Washington commemorating the deeds of military heroes were erected by many societies. It would seem equally appropriate that those interested in scientific progress should commemorate the life and services of a man who was a leader along lines making for constructive rather than destructive work.

The character of the monument will not be decided upon until the fund has been raised, but the committee will be glad to receive from contributors suggestions relating thereto. Subscriptions will be received by H. C. Rizer, United States Geological Survey, Washington.

We are informed that the sum of $600 has been collected in a short time, and with no special effort. We have no doubt that this sum will be largely increased by the many who appreciate the great services rendered by Major Powell to the cause of geology and geological exploration in this country.

Pig Iron Classification

The full report of the American Iron and Steel Association contains a carefully prepared statement of the different kinds of pig iron made, classified according to their quality and the purposes for which the iron was intended. This statement for two years past is given in the following table:

	1907		1908	
	Tons.	Per Ct.	Tons.	Per Ct.
Bessemer	13,027,083	50.5	7,086,360	44.5
Low-phosphorus	204,537	0.8	130,616	0.8
Basic	5,375,219	20.9	4,010,144	25.1
Forge pig	683,167	2.6	457,164	2.9
Foundry	5,066,311	19.7	3,573,210	22.4
Ferrosilicon	84,898	0.3	64,412	0.4
Malleable besse'r	920,290	3.6	414,957	2.6
Spiegeleisen	283,430	1.1	111,376	0.7
Ferromanganese	55,918	0.2	40,642	0 3
Miscellaneous	80,508	0.3	47,137	0.3
Total	25,781,361	100.0	15,936,018	100.0

Low phosphorus pig is iron running below 0.04 per cent. phosphorus. The basic pig does not include a very small quantity of basic iron made with charcoal as fuel. Miscellaneous includes white and mottled iron, castings made direct from the furnace and a few tons of ferrophosphorus. Spiegeleisen contains from 9 to 22 per cent. of manganese; ferromanganese, 45 to 82 per cent. The standard for spiegeleisen is 20 per cent.; for ferromanganese, 80 per cent. manganese.

The more interesting changes are the smaller proportion of bessemer and the larger one of basic iron. It is evident also that the demand for foundry iron did not decrease in quite so great a proportion as that for steel.

Production of Ores, Metals, Minerals and Chemicals in the United States in 1908

The accompanying tables show the production of some of the principal ores, minerals, metals and chemicals, in the United States during 1908, as collected for the forthcoming volume of THE MINERAL INDUSTRY:

PRODUCTION OF SECONDARY MINERALS AND CHEMICALS IN THE UNITED STATES.

Product.	Measure.	1908. Quantity.	1908. Value.
Alundum	lb.	3,160,000	$189,600
Ammonium sulphate	sh.t.	87,600	5,247,240
Arsenic	lb.	2,603,505	99,193
Bromine	lb.	1,149,000	103,410
Carborundum	lb.	4,907,170	294,430
Coke	sh.t.	23,496,666	55,595,792
Copper sulp. (c)	lb.	37,654,961	1,833,797
Copperas	sh.t.	35,334	388,674
Crushed steel	lb.	630,000	44,100
Graphite, artificial	lb.	7,385,511	502,667
Lead, white	sh.t.	116,628	10,515,315
Lead, sublimed, white	sh.t.	9,100	973,000
Lead, red	sh.t.	11,358	1,156,282
Lead, orange mineral	sh.t.	393	43,157
Litharge	sh.t.	12,254	1,231,206
Mineral wool	sh.t.	9,197	77,228
Zinc oxide (m)	sh.t.	65,100	5,816,040
PRODUCTION OF METALS IN THE UNITED STATES.			
Aluminum	lb.	13,000,000	4,095,000
Copper	lb.	948,196,490	127,285,897
Ferromanganese (q)	lg.t.	152,018	6,445,563
Gold, fine	Troy oz.	4,659,562	96,313,256
Iron, pig	lg.t.	15,784,000	267,538,800
Lead	sh.t.	314,067	26,381,628
Quicksilver	flsks. (o)	17,969	805,690
Silver, fine	Troy oz.	51,798,053	27,382,523
Sodium	sh.t.	2,000	1,000,000
Zinc	sh.t.	210,511	19,897,500
Platinum	Troy oz.	510	11,655
PRODUCTION OF THE RARE METALS IN THE UNITED STATES.			
Bismuth	lb.	5,200	6,600
Cadmium	lb.	10,000	9,300
Calcium	lb.	350	520
Magnesium	lb.	500	500
PRODUCTION OF ORES AND MINERALS IN THE UNITED STATES.			
Antimony ore	sh.t.	360	19,800
Asbestos	sh.t.	1,350	24,000
Chrome ore	lg.t.	280	5,600
Coal, anthracite	sh.t.	80,329,578	159,122,961
Coal, bituminous	sh.t.	334,124,486	382,569,166
Fluorspar	sh.t.	39,389	212,647
Garnet	sh.t.	2,530	78,090
Graphite, crystalline	lb.	3,433,039	149,763
Limestone flux	lg.t.	9,650,000	3,860,000
Magnesite	sh.t.	8,967	52,342
Petroleum, crude	bbl. (i)	184,711,413	136,347,831
Tin ore	sh.t.	50	12,500
Tungsten ore	sh.t.	497	126,281
Zinc ore	sh.t.	838,377	.....

(c) By product only. (i) Barrels of 42 gallons. (m) Includes a small quantity made from spelter. (o) Flasks of 75 lb. (q) Includes spiegeleisen, although the value is given as ferro-manganese.

The work on Feb. 1 in the New York State Barge Canal (*Engineering-Contracting*, April 7, 1909) was as follows: Work under contract, 194.1 miles; additional plans completed, 106.2 miles; plans over 75 per cent. completed, 71.9 miles; other plans in progress, 35 miles.

Colliery Notes

A careful miner will make it an invariable rule to use a copper scraper and clean the dust out of every shot-hole before inserting the charge.

At all coal shafts, where sinking operations are going on, the boiler should be set far enough away to make it impossible for a sudden flow of gas from the shaft to become ignited.

It is generally advisable when installing a power plant, to see that the ground at one end of a line of boilers is clear of buildings, so as to permit the addition of other units as required.

When special shot-firers are employed at a colliery, the miners should state the length of each shot-hole with chalk on a piece of board so that the shot-firer can properly proportion the charge required.

With reference to shaft accidents, the consensus of opinion seems to be that greater safety results from the use of detaching hooks rather than from safety catches. Many engineers fear these latter devices because they are liable to come into operation at a time when they are not wanted.

With the inauguration of the new laws regulating the valuation of Government coal lands, the possibility of purchasing cheap fuel beds, in the West, disappears. New River coal in West Virginia (with transportation convenient), can be purchased for $75 an acre, while inferior coal lands in Utah are now valued at more than $300 per acre.

In the mines of Great Britain, the continuous-current system has almost entirely been replaced by the alternating or polyphase-current system of electric supply. This latter is practically safe even in gaseous mines, for with the use of induction motors, the sparking troubles on commutators, which exist in continuous-current motors, are entirely dispensed with.

One authority states that a good feed-water heater will pay for itself in two months' operation. In actual practice, one such heater reduced the fuel consumption 16 per cent. An open heater is better than a closed heater and shows higher efficiency. This type of heater, however, must be used in connection with a good separator for removing the oil from the exhaust.

For use as a secondary-power producer in shaft sinking, the most satisfactory machine yet devised is the simple straight-line air compressor. This type of machine shows greater efficiency than the general run of small engines. A 16x16¼x18-in. compressor will be found sufficiently large to operate three or four drills and a pump in sinking a shaft of moderate depth. Compressed air has so far been found more satisfactory than electricity as a secondary power in shaft sinking.

Where main or main-and-tail haulage is used, the haulage gear of the system of haulage is worked at full power for only one-third of the time; it then stands for about one-third, and runs at a much smaller power for the other third. Consequently the amount of power necessary for dealing with a given output with these types of haulage is much greater than with endless-rope haulage.

More attention is now being directed to the proper utilization of our peat bogs. One authority states that Michigan contains about 8416 sq.m. of swamp land, largely covered by peat and muck. Assuming that one-tenth of the peat area is workable, and figuring on a depth of 10 ft. (60 to 70 ft. is not unusual), this represents an available peat supply of 1,153,000,000 tons, having a gross value of $3,459,000,000. The estimated cost of producing peat varies from $1 to $2 per ton.

Where main-rope haulage is used, it is impossible to fix any definite gradient upon which the cars will run back by gravity; the degree of slope upon which a train of cars will self-act, depends largely upon the weight of the cars, the size of the wheels, the condition of the road, and the weight of the rails. With heavy cars having large wheels, the train will run back on a gradient of less than 1 in 36; however, on an average kept road, with the car wheels of reasonable size, it will generally be found that a gradient of 2 in 26 is a fair allowance.

One authority on shot firing states that where there are high currents of air, the shot-holes should be placed with the direction of the air current, having the mouth of the shot-hole pointing away from the downcast shaft or intake air. This arrangement, it is said, will prevent the shot from blowing against the air. This same engineer believes that the air at many mines contains such a quantity of dust and occluded gas, that explosions have been caused by the concussion of shots against the mine air, which latter, in some cases, is more readily explosive than firedamp, and takes fire at a lower temperature.

The investigations recently carried on in mines after explosions have occurred, have shown that the most poisonous mixture of gases has been found along the track of the main explosion. The most insidious constituent present in these after-gases is carbon monoxide. One point brought out by these examinations is that the average miner will generally make for the main roads in his efforts to escape from the mine. The comment is made that where miners have followed this plan, they have usually been overcome by the poisonous gases encountered. On the other hand, as was shown at the West Stanley disaster in Great Britain, those men who take the circuitous routes instead of the main roads, often get out safely.

An interesting point of difference in the coal mines of Europe and of America, is the shape of the shafts. In most European districts, the circular shaft is generally adopted, owing to the comparative ease with which it is sunk. Engineers who advocate the circular shaft advance the arguments that it is stronger, cheaper to sink and much more able to resist pressure than any other form; on the other hand, the chief disadvantage of the circular shaft is, there is a waste of space between the square formed by the cages, and the circumference of the shaft. However, this space at the present time is utilized as a medium for conveying power cables and pump mains to and from the surface; this space is also valuable as an opening for the free passage of air. In the various coalfields of Great Britain and on the Continent, the rectangular shaft, such as is used in America, has never grown largely in favor. Although the rectangular shaft can be better divided into compartments, and does not involve the waste of space that occurs with the circular form, the difficulty of sinking rectangular shafts, owing to the corners, which have to be kept square, combined with other disadvantages, are said to over-balance the favorable points of this form.

The engineer who attempts to master the problems of mine ventilation, should be familiar with the effects upon human respiration of an atmosphere containing more or less than the normal proportion of oxygen. A normal atmosphere may be regarded as consisting of two gases—oxygen and nitrogen—mixed together in the approximate proportion of 21 per cent. of the former to 79 per cent. of the latter. The proportion of oxygen in mine air may be reduced to as low as 15 per cent. before a person is likely to experience any difficulty in breathing, although lamps and candles will not burn in such an atmosphere. Any further reduction, however, is attended with serious consequences. When only 7 per cent. of oxygen is present in air, the face of the individual becomes gray, the lips blue, there occurs palpitation of the heart and a general dulling of the senses. Since a small deficiency of oxygen occasions such little actual discomfort, great care must be exercised in entering places where there may be a lack of this life-sustaining ingredient, as there are no preliminary symptoms, and in an atmosphere entirely deficient in oxygen, a man would become unconscious in 30 or 40 seconds, with little or no preliminary warning. It is also true that in deep mines, where the atmospheric pressure is greater than that ordinarily prevailing at the surface, a man may safely breathe an atmosphere containing a slightly lower percentage of oxygen than might be considered sufficient at ordinary pressure.

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Contents

PAGE

Editorials:
The Eight-Hour Law in California... 1097
Hand Sorting... 1097
Pig-Iron Production of the World... 1098
Gold Production in Australasia... 1098
*Calumet & Hecla Drill-Sharpening Device...*C. L. C. Fichtel* 1073
Magnesite in India... 1075
*Suction Gas and Its Application to Mining...*George D. Stephen* 1076
Freighting Ore with Big String Teams. *George C. McFarlane* 1078
*A Balloon Survey...*Walter S. Weeks* 1079
*Pyrite Smelting by Knudsen Method in Norway...*E. Knudsen* 1080
*The Coal Dust Question in Great Britain...*Henry Hall* 1084
The Bottineau Gas Field...*John G. Barry* 1089
*Rand Stope Drill Competition... 1090
Amendment to Norwegian Mining Law 1091
Salt in Austria... 1091
Tin Mining and Milling in North Queensland...*G. W. Williams* 1092
Colliery Notes... 1096
Production of French Colonies. *Special Correspondence* 1094
Henry H. Rogers... 1094
A Memorial to Bennett H. Brough... 1095
A Proposed Powell Memorial... 1095
Pig-Iron Classification... 1095
Production of Ores, Metals, Minerals and Chemicals in the United States in 1908... 1095
Correspondence:
*The Cost of Mining Coal. *H. M. Chance* 1099
The "Consulting Engineer" and Question of Ethics...*Subscriber* 1101
Patents... 1102
Personals, Obituaries, Societies and Technical Schools... 1104
Special Correspondence... 1105
Mining News... 1108
Markets... 1113

*Illustrated.

The Eight-hour Law in California

The eight-hour law which was passed by the legislature of California at its last session took effect May 9, and is producing much trouble. The law is positive in its terms and forbids, under penalties, the employment of men underground for more than eight hours out of 24. Moreover, it extends to mills and smelting works, as well as to underground mines. A number of mine owners met in San Francisco recently and decided to take prompt legal action to test the constitutionality of the law, subscribing a fund for the purpose of meeting the expenses of a test case. Meantime they decided to obey the terms of the law, but to limit its action practically as far as possible. Thus they agreed to restrict work to eight hours, but resolved to count actual working time only at the face, excluding all time spent by the men in entering or leaving the mine. This, of course, would vary greatly at diffierent mines, according to depth and other conditions.

The miners are not accepting these terms without active protest, and contend that the eight hours should run from the time they enter the shaft or tunnel until the return to daylight. Several strikes have already occurred. Thus, in the big mines at Jackson and Sutter Creek and thereabouts in Amador county on the Mother Lode, at Campo Seco and at Angels in Calaveras county, in mines at Sierra City, Sierra county, and at some places in Shasta county, the men have struck and refuse to comply with the rule adopted by the operators. The Austrian and Italian miners on the Mother Lode, of whom there are many, insist on working under the new law without any concessions to the operators. At the Shasta county smelting works and in Grass Valley and Nevada City the miners have been working under an eight-hour schedule for some time. The annual meeting of the State Miners' Union No. 2, Western Federation of Miners, occurs this week at Angels, and the question of fighting the operators in the California Miners' Association is to come up. If they decide to do so there will be many individual contests in different mines; but it is doubtful if the mine operators will stand together should this occur. There are many small mines in the State, owned by individuals and small companies, who have not the means or disposition to enter into a long and doubtful contest.

It is contended on behalf of the mine owners that many California mines are operated on a narrow margin; and that in a number of these the small profit might be turned into a loss by shortening the day without a reduction in wages, or by the substitution of three shifts for two. This is probably true in a number of cases. The legislature, however, refused to consider protests against the law on this or other grounds. The probability, judging from precedents in other States, is that the law will stand. There will be much friction, however, before matters are finally adjusted to its operation.

Hand Sorting

Hand sorting as a treatment of ore delivered from the mines is a process that is too often neglected. If practiced in the laborious ways of Mexico and Europe, it is undoubtedly too costly to be applied generally with high priced labor, which is the condition in most parts of the United States. If applied, however, in an economically arranged sorting plant, the process is frequently very profitable, delivering immediately a high-grade concentrate, at comparatively low cost per ton, and without incurring any loss from sliming or otherwise. A concentrating mill, meaning a jig or table mill, is the fashionable accessory to a mine. But there are many mines that lie idle for years, awaiting the provision of a plant of machinery for crushing and washing, which could be made to pay their way and eventually obtain the necessary mill by the introduction of a good system of hand sorting.

Even after the concentrating mill has been provided, it is frequently the case that ore is run through it which would better be removed by hand sorting. This is the case, for example, with ore of low grade, considering the general average, which nevertheless contains a good deal of galena that by the first crushing is liberated in pieces of ¾ to 1 in. in diameter. To run such ore through the crushers and rolls of the ordinary concentrating mill is but little short of criminal.

The conditions that we have mentioned exist to a large extent in the Cœur d' Alene. The absence of hand sorting in that district was for a long time a fea-

ture that attracted the attention of visitors. However, during the last year or two there has been a general introduction of picking plants, all of the big mines having been thus equipped, except the Morning and the Hunter. In fairness we must say that this is no new thing, inasmuch as the excellently managed Bunker Hill & Sullivan has practiced hand sorting to a more or less extent for upward of five years and is continuing to do so.

In the present practice of the Cœur d' Alene, the ore is roughly sorted into shipping product, concentrating ore and waste, the shipping ore being sent to the smelters and the waste being returned to the mines for filling. Because of this sorting the shipments of crude ore from the Cœur d'Alene increased materially in 1908 as compared with 1907. Opinion is not unanimous, however, as to the result of the practice. According to some authorities the sorting has considerably increased the extraction of ore, by reducing the slime losses which formerly were large, owing to the unnecessary crushing of brittle mineral. An advantage in hand sorting is found also to be the throwing out of sticks and blocks of wood coming from the mine, thereby preventing chokes in the launders of the mill.

The drawbacks to hand sorting in the Cœur d'Alene are: (1) High cost of labor, $3 per nine-hour shift, and the impracticability of using boys or any form of cheaper labor. (2) The lower grade of the concentrate produced by hand sorting as compared with the mill concentrate. Against these drawbacks is undoubtedly a higher extraction of mineral, but the amount of the latter is difficult to determine. It is next to impossible to sample the product of the mines that goes to the sorting house, and in fact the matter of ore extraction is practically carried back to the stopes.

Some mines in the Cœur d'Alene do indeed practice ore sorting to a decided extent in the stopes. All the ore mined by them is moved by hand from the place where it was broken to the ore chute. During this transfer first-class ore is picked out in large chunks, while freshly broken and clean, by the mine laborers (without otherwise interfering with their work) as an incident in the mucking of the ore. In certain mines, however, a limitation of this practice has been found in the insufficiency of chutes, or other facilities, by which the accumulated first-class ore in the stopes can be segregated and brought to the surface. It is safe to say that when sorting of this kind can be successfully practiced underground, it may be continued even more advantageously on the surface where suitable provisions may be made. The most reliable gage of the value of the practice is, of course, the ledger of the bookkeeper.

Pig Iron Production of the World

The total pig-iron production of the world in 1908 showed a decrease of 12,476,000 tons, or a little over one-fifth from that of 1907. The greater part of this loss—over five-sixths—was in the production of the United States. The depression extended to all European countries which report decreases of greater or less amount; but none of them compare at all with the sharp and extreme reduction in our own output. This was to be expected, since European fluctuations in manufacture are never so violent in either direction as those of the United States. The small production of last year offsets the great make of 1906 and 1907. Following the United States, the larger losses in 1908 are found in those countries where the iron trade is most active usually, as in Germany, Great Britain and Belgium; but the reductions were only 15.5 per cent. in Belgium, 9.4 in Germany and 6.4 in Great Britain, compared with 38.6 per cent. in the United States.

The accompany table, prepared for THE MINERAL INDUSTRY, gives the pig-iron production of the world in 1907 and 1908, reduced to metric tons; the third column showing the percentage of change last year:

PIG IRON PRODUCTION OF THE WORLD.
IN METRIC TONS.

	1907.	1908.	Change, Per Cent.
United States	26,193,863	16,190,994	D. 38.6
Germany	13,045,760	11,813,511	D. 9.4
Great Britain	10,082,638	9,438,477	D. 6.4
Three leading producers	49,322,261	37,442,982	D. 24.1
Austria-Hungary	1,405,000	1,390,000	D. 1.1
Belgium	1,427,940	1,206,440	D. 15.5
Canada	590,444	572,183	D. 3.1
France	3,588,949	3,391,150	D. 5.5
Italy	32,000	32,500	I. 1.6
Russia	2,768,220	2,748,000	D. 0.6
Spain	385,000	375,000	D. 2.6
Sweden	603,100	563,300	D. 6.6
All other countries	625,000	550,000	D. 12.0
Total	60,747,914	48,271,555	D. 20.5

The extent of the change is illustrated by the fact that in 1907 the United States made 43.1 per cent. of the pig iron of the world; in 1908 only 33.6 per cent. The proportion made by the three chief producers was 81.2 per cent. in 1907 and 77.8 in 1908. Further, the make of the United States in 1907 was 3,065,465 tons more than the combined output of Germany and Great Britain; while in 1908 it was 5,060,994 tons below their united production.

both of Chihuahua.

Gold Production in Australasia

The gold production of Australasia for the first quarter of 1909, as officially reported, shows a loss of 7.9 per cent., or very nearly $1,400,000, as compared with the first quarter of 1908. In the six States of the Commonwealth of Australia the loss was 7.2 per cent.; while in New Zealand there was a decrease—hardly anticipated—of 11.7 per cent. In every case there was a decline from last year, though some of the changes were small.

The total Australasian production for the three months was as follows, in ounces of fine gold, South Australia and Tasmania being estimated:

	1908.	1909.	Changes.
New South Wales	62,562	47,403	D. 15,159
Queensland	93,145	92,722	D. 423
South Australia	2,400	2,350	D. 50
Tasmania	15,625	14,500	D. 1,125
Victoria	149,933	141,805	D. 8,128
West'n Australia	410,631	382,395	D. 28,236
Commonwe'lth	734,296	681,175	D. 53,121
New Zealand	124,318	109,761	D. 14,557
Total, oz.	858,614	790,936	D. 67,678
Total value	$17,747,551	$16,348,647	D. $1,398,904

The greatest actual decline was in Western Australia, and was due to a decrease in the values of ores in the principal mines, rather than to diminished activity. The largest proportional loss was in New South Wales, and resulted for the most part from the diversion of men from mining to other industries. In Victoria there were fair increases in January and February, but for some unexplained reasons a heavy decrease in March brought the total for the quarter down to a lower point than last year. The New Zealand loss was chiefly from the dredging industry, which has been falling off for some time.

If the first quarter is to be taken as an index, the prospect for Australasia is that the gold production for 1909 will show a continuation of the decline which has been going on for several years. It is quite possible, however, that increases may be shown in the latter part of the year, as is frequently the case there. The attention given to the mining of other metals, especially copper, has not been without its effect on the gold-mining industry.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

The Cost of Mining Coal

The contribution to the literature of this subject in the JOURNAL of May 8, 1909, is both unique and instructive, and may be regarded as a classic which may be profitably studied by engineers and managers who desire to master the subject in its broadest conceptions. Mr. Finlay has rendered an invaluable service in showing how conclusions, both useful and specific, may be deduced from entirely general and non-specific data. Many business men who are not engineers, as well as engineers who have the business instinct, have the faculty of "sizing up" matters of cost and profit, from data such as Mr. Finlay uses, by a process possibly identical with the methods elaborated by Mr. Finlay. That article and the similar contribution on the "Cost of Pig Iron Made from Lake Superior Ore," furnish the material for a treatise defining the methods of which costs may be computed with a close approach to accuracy. When the engineer is confronted by difficulties which may seem insurmountable because of the impossibility of obtaining actual figures of cost, or of securing access to cost sheets, he has merely to adopt Mr. Finlay's methods to reach conclusions which will furnish close approximations to the truth.

Expressing this method mathematically we may write:

$$C = \frac{4\,W}{3\,O} + d + i + a;$$

in which

C = Cost per ton,
W = Average rate of wages per day of all employees,
O = Daily output in tons per employee,
d = Depreciation of plant per ton of output,
i = Interest on capital per ton of output,
a = Amortization charge per ton of output.

While there may be material differences in judgment as to what constitute proper depreciation, interest and amortization charges, if these be fixed by adopting current rates of interest and valuations determined by property appraisals in harmony with prices at which similar property is salable, these differences will not be large enough to make a material difference in the final result. In some cases a nearer approximation to actual costs will be obtained by changing the numerical factor $\frac{4}{3}$ to $\frac{3}{2}$, making the formula read:

$$C = \frac{3\,W}{2\,O} + d + i + a.$$

In the absence of actual cost sheets or other data, the investigator has therefore to learn the average rate of wages of all employees, the average output in tons per employee, the approximate investment in plant and improvements, and in lands, etc., to enable him to make a close estimate of the cost per ton. The numerical factors $\frac{4}{3}$ and $\frac{3}{2}$ introduce an empyrical method of approximating the cost of materials, supplies and incidental expenses, which in practice is generally from one-fourth to one-third of the gross cost. In other words, if the gross cost of mining be $1 per ton, the labor cost is usually from ⅔ to ¾ (66 to 75c.) of this amount, and the balance, 1/3 to ¼ (33 to 25c.), represents these other items.

It may be thought that the experienced mine manager or engineer should be able to make such estimates from his special knowledge of the conditions in any district, and this is true if the engineer be personally familiar with the district or if he has had experience under practically like conditions, but even those of the widest experience will find the method useful in examining propositions located in districts with which they are not familiar, especially in checking up general conclusions based upon data furnished by parties in interest and which may be more or less unreliable.

Mr. Finlay makes a remarkable statement concerning the rate of wages when he says, "I do not believe that this is a factor at all." In its broadest sense this statement is possibly true, and the arguments which Mr. Finlay advances to support it are plausible and convincing, but the statement is one likely to be misunderstood and perhaps misapplied. I do not imagine that Mr. Finlay intends to convey the idea that an increase in the wage scale will not increase the cost of mining coal, but on the contrary as I understand the argument, he means that local differences in the wage scale result from differences in the cost of living in the climate, social environment, etc., and that such differences are apparent but not real differences; that the wage scale is the measure of the value of work done, being the compensation received for such work and that the law of supply and demand keeps this practically uniform throughout the country. The same argument can with equal force be applied to all countries. While the question is one of academic interest, it has some practical bearing upon the issue and should be carefully considered, and Mr. Finlay has rendered a distinct service in directing attention to it.

A correct determination of the cost of mining is the most important function of the engineer when acting in an advisory capacity, for upon it must be based the appraisals of money values and advice as to whether the property can profitably be worked. If the cost be too high to permit profitable operation, its present money value must be small, its purchase may be undesirable, or if purchase has already been effected, its immediate sale may be advisable. The practical problem which the advisory engineer must solve is specific. It rarely relates to average cost in a given district (although for purposes of comparison this must be known), but on the contrary, is usually the determination of mining cost at a given property under existing physical and economic conditions, and the value of the service rendered must always depend upon the accuracy with which this is determined. The engineer has rarely to speculate upon questions affecting the wage scale, as this scale is usually known and fixed; farther, as any change in the scale will affect the cost of all competitive properties in nearly the same ratio, such possible changes may be disregarded. The pertinent question as to whether the property can be made to produce coal at a cost not exceeding the average cost in the district; if not, then the venture has a doubtful future; otherwise it may be favorably considered—assuming of course that the quality of the coal is equal to the average quality produced in that district.

THICKNESS OF COAL IS PRINCIPAL FACTOR

In addition to what Mr. Finlay has said, it may be useful to emphasize the fact that the principal factor affecting the cost of mining is the thickness of the coal. To graphically illustrate this, I submit a diagram showing cost curves which have been constructed to show how the thickness affects the cost of mining anthracite coal in Pennsylvania. These curves have been plotted from a large

collection of data, including actual costs under widely varying conditions.

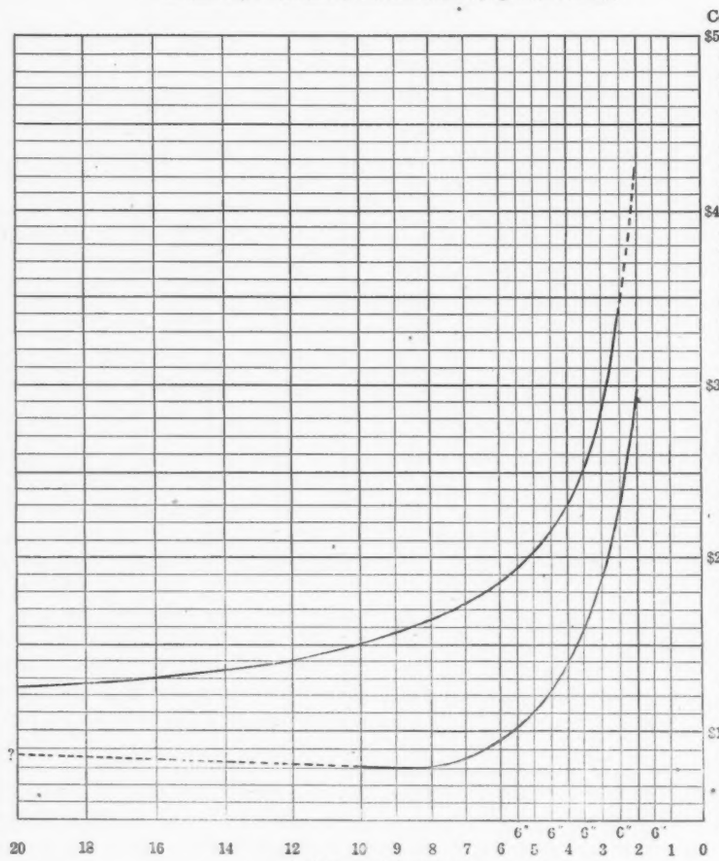
The costs shown by these curves include all items properly chargeable to mining, but do not include the cost of preparing coal for market. These costs are not "run-of-mine" costs because they are computed by dividing the total cost of production by the number of tons of merchantable coal produced, excluding the waste and coal burned under the boilers of the mining plant. The items thus included embrace labor of every description, skilled, unskilled, clerical, etc., all materials used in repairs, maintenance and construction, all supplies consumed, general office expenses, etc., and new equipment bought in ordinary course of operation and development, as well as the cost of exploratory and other work incidental to consistent maintenance of property and increase of output. The items not included are the cost of preparing coal for market, cost of selling output, taxes, interest on investment, depreciation (cost of plant having been charged to operation) and amortization of value of lands.

The costs as computed for these curves do not include any operations where the coal is mined by stripping in open-cut work, or where the coal is above water-level and is opened by drifts or tunnels, and are applicable only to coal opened for mining below water-level by shafts or slopes.

From an examination of the upper curve it will be seen that under favorable mining conditions (small output, poor management, depth and roof, faults, rolls, gas, crushed coal, water, slate and rock partings) the coast ranges from $1.25 to $1.30 for beds containing from 15 to 20 ft. of coal, up to about $3.40 for beds 2 ft. 6 in. thick. The curve beyond the 2½-ft. line is hypothetically prolonged to the 2-ft. line, there being no actual figures available, for in the presence of unfavorable conditions coal less than 2 ft. 6 in. thick is rarely worked.

From an inspection of the lower curve it will be seen that when the conditions are favorable, the cost ranges from $0.80 or $0.85 for thick coals, up to from $2.30 to $2.90 for beds containing from 2½ to 2 ft. of coal. It will be noted that the cost increases rapidly in the case of coals less than 4 ft. in thickness and that at the 3-ft. line the curve becomes very steep.

Curves showing Cost of Mining Anthracite Coal, as affected by thickness of the coal worked, by H.M. Chance.



Upper Curve shows Costs under Unfavorable Mining Conditions
Lower Curve " " " Favorable " "

The Engineering & Mining Journal, N.Y.

The average hight of man limits the possibility of cheap mining to beds of coal 4 ft. or more in thickness; if man had a stature of 20 ft. he could mine coal 6, 8 or 10 ft. thick only by removing much rock or slate to gain room in which to work; if he stood but 2 ft. high, he could work beds 18 in. thick without removing any of the roof or floor to gain headroom. Hence for this and other reasons, we cannot hope to work thin coals at anything like an approach to the low costs which may be reached in mining thicker beds.

In addition to this limitation fixed by the hight and size of the miner, the following conditions tend to increase the cost of mining thin coal seams:

1. The yield per acre is less, therefore the cost per ton for headwork, gangways, airways, shafts, cross-cuts, is correspondingly increased.

2. The yield per acre being less, more acres are required for a given output, the average underground haul is correspondingly longer and the haulage cost per ton is increased.

3. For the same reason the quantity of water to be pumped per ton of coal developed is larger, and the cost for pumping per ton of coal produced is correspondingly increased.

4. For the same reason the cost of ventilation per ton of coal is larger, often many times larger than in working thick coals.

5. The interest charge (account plant and equipment) is larger per ton of coal produced.

6. The cost of superintendence per ton of coal produced is larger.

A merely cursory investigation of these factors is sufficient to show that the thickness of workable coal is of predominating importance in determing the cost of mining.

By reference to the cost curves it is seen that the average difference in the cost of mining due to the presence of favorable or unfavorable mining conditions, in mining the thicker beds is from $0.50 to $1 per ton, and in mining the thinner beds is from $1 to $1.10 per ton.

It will of course be understood that in many cases where quite exceptional conditions are present, the costs may differ materially from those indicated by these curves; for example, a coal bed may contain 10 or 12 ft. of coal, but may be so crushed and faulted and contain so much waste that the mining cost may exceed $2 per ton. These curves have not been constructed to include exceptions of this kind, being intended to show how, under fairly normal conditions the average costs vary with the thickness of the coal worked. The two curves shown, one to represent costs under conditions adverse to cheap mining, and the other under

conditions favorable to cheap mining, illustrate the ordinary extremes under what may be termed normal conditions.

These curves represent the experience at no particular operation, nor of any particular operating company. Owing to the varying conditions at different operations and in different localities, curves showing costs at single operations, or of the combined operation of several collieries under one management, would in many cases show little similarity to those shown by the diagram illustrating this article. A similar curve to show mining costs as affected by thickness of coal worked under present *average* mining conditions in the anthracite districts, might be used to show the actual cost of mining anthracite coal—but that is a matter entirely foreign to the purpose of this article.

At some future time I hope to construct similar curves to illustrate the effect of variations in thickness on the cost of mining bituminous coal. To make such illustrations effective and useful they should each represent the conditions and costs in a single field or district. In a general way the same principles apply to bituminous as to anthracite mining. In both, the thickness of workable coal is the factor of greatest importance in determining costs. Assuming that the wage scales in two districts, or at two mines, are equal, or practically equal, and that neither mine nor district has any overwhelming natural advantage over the other, the factor ranking next in importance is that of daily output. Large output should mean low cost. Next in importance, and often of greater importance than the output, is the character and ability of the management. Mr. Finlay has sufficiently emphasized the importance of the personal ability of the operator or manager in reducing costs. Good management implies efficient equipment, regularity of output and intensive operation. Unless hopelessly handicapped by natural obstacles (faults, thin coal, poor roof, deficient equipment or lack of a market), good management should insure the profitable operation of any coal property.

H. M. CHANCE.

Philadelphia, Penn., May 11, 1909.

The "Consulting Engineer" and a Question of Ethics

The writer, who is a layman, has always had a vague respect for what are known as the ethics of the learned professions. Yet the following incident, which recently happened in New York, leads me to inquire if engineering societies prescribe any code of ethics for their members: Mr. B, a member of the American Institute of Mining Engineers, while acting as consulting engineer and stock-transfer agent for a gold-mining concern, having an office in New York, receives reports of new ore discoveries in the mine. B thereupon makes an agreement with H, one of the company's directors, and with G, a stockbroker, to turn over to these two such stock as he can buy at a low figure from stockholders of his acquaintance on condition that B have an option on one-third of stock so purchased, at cost plus 6 per cent. interest. It is agreed that H and G are to provide the money for purchase of stock. In some instances B buys stock directly from owners by withholding all good news and by posing as a disinterested broker for the seller. Afterward the stock rises to a price on the New York Curb equal to five times the purchase price. After the three parties, B, H and G, have divided their stock holdings among themselves B (as the company's transfer agent) refuses to return to G stock certificates which the latter has sent in for transfer. B's only excuse is that a syndicate of directors interested in the stock, do not want B to return the stock. Presumably the syndicate did not want this stock to appear on the Curb where they might have to purchase it. Other parties' stock was held up in a similar manner.

Does the JOURNAL consider that B has been faithful to his profession of consulting engineer, to the stockholders of the corporation employing him, or to those whom he, in the guise of a broker, induced to become his clients?

SUBSCRIBER.

Philadelphia, Penn., May 17, 1909.

[The term "consulting engineer" is being employed in ways that are so meaningless that we expect to see it entirely given up by the leaders of the profession. Inasmuch as any bootblack or chiropodist may be a "professor," why should not anyone be a "consulting engineer?" The new graduate who opens an office immediately becomes a "consulting engineer." The superintendent or manager out of a job and waiting for another one to turn up subscribes himself in the meanwhile as "consulting engineer," because he thinks that the adjective implies that he is doing something, which simple "mining engineer" might not. Some eminent engineers are officially entitled by the large companies that exclusively employ their services as "consulting engineer" for such and such company, which title is supposed to be higher than that of general manager. It has even been explained before a court of law that a consulting engineer is one who manages managers.

Now the very title of consulting engineer implies action in an advisory capacity. The engineer may often act strictly and solely in that capacity, just as the medical and legal men do, but often it is unsatisfactory to the engineer to give advice without assurance that his recommendations will be properly carried out, and the execution may be left entirely to him. He then becomes a managing engineer, or a managing director. The continued use of the title of consulting engineer manifests a poverty of invention in the matter of titles. The superintendent is under the general superintendent. The general superintendent is under the general manager. If the organization requires that someone shall be over the general manager, why not call the next rank the "managing director," or "director general?"

For example, Pope Yeatman is in reality the director-general of the Nevada Consolidated, Cumberland-Ely and Steptoe Valley companies. If any one of those companies should go to Dr. Peters for advice, they would go to him as a consulting engineer. This matter of title is not, like some others, a quibbling over dignity, and consequently of no importance, but on the contrary is one upon which some live questions of ethics depend. It is indeed the keystone of the question that is being discussed by the Mining and Metallurgical Society of America, with respect to the conditions under which an engineer is justified in accepting a contingent fee. In the course of this discussion Dr. H. M. Chance put the question very well in the following words:

"When an architect becomes the superintendent of construction for a firm of contractors, for the time being he ceases to be recognized as a professional architect; when a civil engineer becomes division superintendent of a railroad, he is no longer a civil engineer; and even when a lawyer becomes president of a corporation the public no longer regards him as a professional man; yet many mining engineers continue to be known as mining engineer for many years after they may have ceased entirely to do any professional work. This breeds confusion in the public mind, and a vague idea that the mining engineer is properly manager, inventor, promoter, or adviser at the same time, and consequently may be expected to act as his interests and those of his principals may require."

In the specific case cited by "Subscriber," the combination of consulting engineer and stock transfer agent suggests the incongruous. We shall make no comment upon this discord, but simply shall ask "Subscriber" to try to imagine J. Parke Channing, or John Hays Hammond filling those dual positions.

As to the ethics of the action of Mr. B as a stock-transfer agent, his relation to his company, his duty to his stockholders, etc., we do not think it necessary to express any opinion. We think, however, that the "gold-mining concern" in question might advisably follow the example of many large companies and entrust its stock transferring, etc., to some regularly organized and fully responsible institution. —EDITOR.]

Patents Relating To Mining and Metallurgy

A Selected and Classified List of New Inventions Described during the Past Month in the Publications of the Patent Offices

UNITED STATES AND BRITISH PATENTS

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

ALUMINUM

ALUMINUM OXIDE—A Process for the Electrolytic Production of Aluminum Oxide. Frank W. Morris, Victoria, B. C. (Brit. No. 6449 of 1908.)

ELECTROLYTIC EXTRACTION—Art of Extracting Aluminum and Other Metals. Henry S. Blackmore, Mount Vernon, N. Y. (U. S. No. 920,893; May 4, 1909.)

ANTIMONY

ORE TREATMENT—An Improved Process of and Apparatus for Treating Antimony and Other Ores. Henri L. Herrenschmidt, Paris. (Brit. No. 7429 of 1908.)

ASPHALT

BY-PRODUCTS—A New or Improved Process for the Production of By-products from Asphaltum, and the Like. Smith Everett, London. (Brit. No. 27,335 of 1907.)

SEPARATION PROCESS—Means for Separating Bitumen from Bitumen-Bearing Ore. George M. Willis, Chicago, Ill. (U. S. No. 918,628 and 918,629; April 20, 1909.)

COAL AND COKE

BRIQUETS—Method of Producing Anthracite Briquets. John F. Lovejoy, New York, N. Y., assignor of one-half to Abe Stein, New York, N. Y. (U. S. No. 921,550; May 11, 1909.)

BRIQUETTING—Fuel-Briquet Machinery. Robert Devilliers, New York, N. Y. (U. S. No. 920,838; May 4, 1909.)

COKE—Improvements in Apparatus for Quenching, Screening and Loading Coke. Albert Goodall, Spennymoor, Eng. (Brit. No. 9226 of 1908.)

COKE—Regenerator System for By-Product Coke-Ovens. Hugh Prentice, Bellevue, Penn. (U. S. No. 920,647; May 4, 1909.)

COKE-OVEN. Carl Schroeter, Chicago, Ill., assignor of one-third to James F. Hill, Chicago, Ill. (U. S. No. 922,201; May 18, 1909.)

COKE-OVENS—Improvements in, or Connected with Coke-Ovens. The Coke-Ovens and By-Products Company, Ltd., and Stephen N. Wellington, London. (Brit. No. 6223 of 1908.)

COKE-OVENS—Improvements in, or Relating to Regenerative Coke-Ovens. Joseph Mueller, Herne, Germany. (Brit. No. 11,688 of 1908.)

MINING METHODS—An Improved Method of Mining Coal, or the Like. Harry A. Kuhn, Pittsburg, Penn. (Brit. No. 9074 of 1908.)

SEPARATOR—Coal and Slate Separator. Herbert Mathewson, Shenandoah, Penn. (U. S. No. 920,972; May 11, 1909.)

COPPER

EXTRACTION FROM ORES—Process of Extracting Copper from Ores. Caleb G. Collins, Woodmere, N. Y., assignor to Calvin Amory Stevens, New York, N. Y. (U. S. No. 919,130; Apr. 20, 1909.)

MATTES—Improvements in the Treatment of Copper Mattes. James T. Carrick and Basil S. Pattison, Johannesburg, Transvaal. (Brit. No. 12,750 of 1908.)

RECOVERY OF COPPER—An Improved Process for Eliminating Lead and Other Impurities, such as Arsenic and Antimony, from a Plumbiferous Copper Matte, Ore or Alloy, and Simultaneously Recovering the Copper as Metal. Société Anonyme Usine de Désargentation, Hoboken-lez-Anvers, Belgium. (Brit. No. 19,585 of 1908.)

GOLD AND SILVER

AMALGAMATOR. George H. Loucks, Chicago, Ill. (U. S. No. 920,880; May 4, 1909.)

CYANIDE PROCESS—Process of Extracting Precious Metals from their Ores. William L. Imlay, Conestoga, Penn., assignor to William L. Imlay Rapid Cyanide Process Company, a Corporation of South Dakota. (U. S. No. 919,434; April 27, 1909.)

EXTRACTION OF GOLD—Improvements in Extracting Gold from its Ores and Apparatus Therefor. Amédée M. G. Sébillott and Louis Maucalire, Paris. (Brit. No. 5481 of 1908.)

EXTRACTION OF SILVER—Process of Extracting Silver from Its Ores. James C. Pryor, North Bay, Ontario, Canada. (U. S. No. 918,908; April 20, 1909.)

GOLD-SEPARATOR. Levan L. L. Swenson, Longmont, Colo. (U. S. No. 917,906; April 13, 1909.)

PLACER-GOLD SEPARATOR. Thomas G. Leavell, Spokane, Wash., assignor of one-fifth to William J. Parks, one-fifth to Henry L. Herkelrath, one-fifth to Edmund E. Brandt, and one-fifth to Merton J. Hills, Spokane, Wash. (U. S. No. 919,894; April 27, 1909.)

REFRACTORY ORE TREATMENT—Process of Removing Sulphur, Arsenic, and Other Like Impurities from Refractory Ores. Frank Cotton, Hornsby, New South Wales, Australia. (U. S. No. 922,088; May 18, 1909.)

IRON AND STEEL

BASIC BESSEMER PROCESS—Manufacture of Iron or Steel by the Basic Bessemer Process. Josy Flohr, Rodange, Luxemburg, assignor to Société Anonyme des Hauts-Fourneaux et Forges de Dudelange, Dudelange, Luxemburg. (U. S. No. 920,560; May 4, 1909.)

CINDER CARS—Tilting Device for Cinder-Cars. Mary B. Veitch, Bessemer, Ala., administratrix of Richard C. Veitch, deceased. (U. S. No. 916,636; Mar. 30, 1909.)

ELECTRIC REFINING OF STEEL—Improvements in and Relating to the Refining of Steel in Electric Furnaces. Communicated from the Company Bismarckhütte, Bismarckhütte, Germany. (Brit. No. 14,926 of 1908.)

FERRO-ALLOYS — Process of Making Ferro-Nickel and Nickel-Steel. Franklin R. Carpenter, Denver, Colo. (U. S. No. 922,388; May 18, 1909.)

FLUE DUST—Method of Utilizing Furnace-Flue Dust. Thomas M. Phillips, Youngstown, Ohio, assignor of one-third to the Youngstown Steel Company, Youngstown, Ohio, a Corporation of Ohio, and one-third to Edward L. Ford, Youngtown, Ohio. (U. S. No. 919,073; Apr. 20, 1909.)

FURNACE OPERATION—Means for Cooling Furnace-Walls. Luther L. Knox, Pittsburg, Penn., assignor to Keystone Furnace Construction Company, Pittsburg, Penn., a Corporation of Pennsylvania. (U. S. No. 919,190; April 20, 1909.)

GAS PRODUCERS—Improvements in, or Relating to Gas Producers for Use in Melting, Heating and the Like in the Manufacture of Steel. George E. Scoby-Smith, Bolton, Eng. (Brit. No. 12,856 of 1908.)

METALLURGY OF STEEL. William S. Simpson and Howard Oviatt, London, England. (U. S. No. 918,382; April 13, 1909.)

OPEN-HEARTH FURNACE. Luther L. Knox, Ben Avon, and Montgomery Murray, Wilkinsburg, Penn., assignors to Keystone Furnace Construction Company, Pittsburg, Penn., a Corporation of Pennsylvania. (U. S. No. 919,184; April 20, 1909.)

OPEN-HEARTH FURNACES—Air and Gas Port for Open-Hearth Furnaces. Frank D. Carney and Thomas T. McEntee, Steelton, Penn., assignors, by mesne assignments, to Keystone Furnace Construction Company, Pittsburg, Penn., a Corporation of Pennsylvania. (U. S. No. 919,125; April 20, 1909.)

ORE TREATMENT—Improved Method of and Apparatus for Treating Ores. John T. Jones, Iron Mountain, Mich. (Brit. No. 5515 of 1908.)

ORE TREATMENT—Method of Treating Iron Ore. Communicated from John T. Jones, Iron Mountain, Mich. (Brit. No. 12,322 of 1908.)

PRODUCTION FROM FINELY-DIVIDED ORES—Improvements in, and Apparatus for, the Production of Iron from Finely Divided Ores. Philip M. Pritchard and the United Alkali Company, Ltd., Liverpool, Eng. (Brit. No. 6561 of 1908.)

REGENERATIVE REVERSING FURNACE. Luther L. Knox, Ben Avon, Penn., assignor to Keystone Furnace Construction Company, Pittsburg, Penn., a Corporation of Pennsylvania. (U. S. No. 919,185; April 20, 1909.)

LEAD

ELECTROLYTIC REFINING — Treating Anode Slime from the Electrolytic Refining of Lead. Anson G. Betts, Troy, N. Y. (U. S. No. 918,647; April 20, 1909.)

FURNACE. Louis S. Hughes, Joplin, Mo., assignor to Picher Lead Company, Joplin, Mo., a Corporation of Missouri. (U. S. No. 920,333; May 4, 1909.)

LITHARGE—Method of Manufacturing Litharge. Louis S. Hughes, Joplin, Mo., assignor to Picher Lead Company, Joplin, Mo., a Corporation of Missouri. (U. S. No. 920,335; May 4, 1909.)

METALLURGICAL FURNACE. Louis S. Hughes, Joplin, Mo., assignor to Picher Lead Company, Joplin, Mo., a Corporation of Missouri. (U. S. No. 920,334; May 4, 1909.)

ORE TREATMENT—Method of Treating Argentiferous Lead Ores. Oliver H. Picher, Joplin, Mo. (U. S. No. 920,388; May 4, 1909.)

SUBLIMED WHITE LEAD—Method of Manufacturing Sublimed White Lead. Louis S. Hughes, Joplin, Mo., assignor to Picher Lead Company, Joplin, Mo., a Corporation of Missouri. (U. S. No. 920,332; May 4, 1909.)

NICKEL

RECOVERY FROM SILICIOUS ORES—Process of Recovering Nickel from Silicious Ores. Adolphe Chalas, Philadelphia, Penn. (Brit. No. 18,596 of 1908.)

PETROLEUM

OIL-WELLS—Device for Pulling Oil-Wells. Lawrence J. McKinney, Prairie Depot, Ohio. (U. S. No. 920,615; May 4, 1909.)

PUMPING—Apparatus for Pumping Oil from Petroleum-Wells. Karel E. Ehrmann, Bajoeng Lentjir, Sumatra. (U. S. No. 919,142; April 20, 1909.)

SULPHUR AND PYRITES

FURNACE—Improvements in Furnaces for the Combustion of Mineral Sulphur. Giuseppe Oddo, Pavia, Italy. (Brit. No. 21,255 of 1908.)

TREATMENT OF PYRITES LIQUOR for Winning Metals Therefrom. John H. Thwaites, Peteborough, England. (U. S. No. 921,312; May 11, 1909.)

TIN

DETINNING—Process of Removing and Recovering Tin. Julius Elkes, Mount Pleasant, Penn. (U. S. No. 919,839; April 27, 1909.)

RECOVERY FROM WASTE — Improved Process and Apparatus for the Recovery of Metallic Tin from Waste Tinned Metal, Mixtures and Alloys of Tin and Lead, and Similar Metal Waste. Albert Nodon, Bordeaux, France. (Brit. No. 7584 of 1908.)

ZINC

DISTILLATION-FURNACE. Woolsey M. Johnson, Hartford, Conn., assignor to the Continuous Zinc Furnace Company, Hartford, Conn., a Corporation of Connecticut. (U. S. No. 920,473; May 4, 1909.)

EXTRACTION FROM ORES AND RESIDUES—Improvements in, or Relating to, the Extraction of Zinc from Ores and Zinc Residues. Woldemar Hommel and the Metals Extraction Corporation, Ltd., London. (Brit. No. 27,020 of 1907.)

EXTRACTION PROCESS—Methods of Extracting in the Shape of Oxides, Sulphites and Sulphates Zinc and Other Metals from

Ores and Products Containing Them. Wilhelm Troeller, Frankfort-on-Main, Germany. (Brit. No. 6888 of 1908.)

FURNACE—Revolving Furnace for Volatilizing Zinc Ores. Harry H. Hughes, Springfield, Mo. (U. S. No. 920,143; May 4, 1909.)

FURNACE OPERATION — Improvements Relating to the Exhaustion or Extraction of Dust and Fumes Produced by Zinc Furnaces and the Like. Emile Dor-Delattre, Dorpiein, Holland. (Brit. No. 13,146 of 1908.)

PROTECTION OF WORKMEN—Means for Protecting Operatives of Zinc and Analogous Furnaces from Heat, Fumes and Dust. Emile Dor-Delattre, Liege, Belgium. (U. S. No. 921,375; May 11, 1909.)

RECOVERY OF ZINC COMPOUNDS—Method of Recovering Zinc Compounds and Ammonia, from By-Products of Galvanizing. Elias G. Pearlman and Martin M. Pearlman, Philadelphia, Penn. (U. S. No. 919,375, and 919,376; April 27, 1909.)

SMELTING—Process of Smelting Zinc Ores. Anson G. Betts, Troy, N. Y. (U. S. No. 918,648; April 20, 1909.)

ZINC OXIDE—Method of Manufacturing Zinc Oxide. Louis S. Hughes, Joplin, Mo., assignor to Picher Lead Company, Joplin, Mo., a Corporation of Missouri. (U. S. No. 920,336; May 4, 1909.)

ZINC OXIDE—Method of Making Zinc Oxide. Louis S. Hughes, Joplin, Mo., assignor to Picher Lead Company, Joplin, Mo., a Corporation of Missouri. (U. S. No. 920,337; May 4, 1909.)

MINING—GENERAL

BLASTING—Means for Detonating Dynamite and Other Explosives. Frank Wells, Philadelphia, and George E. Potts, Pottsville, Penn., assignors to the Potts Powder Company, a Corporation of Pennsylvania. (U. S. No. 918,907; April 20, 1909.)

HOISTING—Improvements in, or Connected with the Prevention of Overwindings in Mines. Harry B. Daglish and William S. Beck, St. Helens, Eng. (Brit. No. 6389 of 1908.)

VENTILATION—Improvements in the Ventilation of Mines. Albert G. Ford, Exeter, Eng. (Brit. No. 12,348 of 1908.)

ORE DRESSING

BALL MILL with Feed of Fresh Material at the One End, Removal of the Material at the Other End, and Return of the Coarse Ground Material on the Circumference of the Grinding Drum. Richard Beneke, Bromberg, Germany. (Brit. No. 15,453 of 1908.)

CONCENTRATING TABLES — Improvements in Concentrating Tables for Treating Fine Mineral Matters. Armelin Bernard and Luigi Sanna, Paris. (Brit. No. 19,314 of 1908.)

CONCENTRATORS—Improvements in and Relating to Ore Concentrators. Seth R. Swain, Denver, Colo. (Brit. No. 13,747 of 1908.)

CONCENTRATION—Method and Apparatus for Saving Slimes in Ore Concentration. James N. Flood, Denver, Colo. (U. S. No. 919,709; April 27, 1909.)

ELECTROMAGNETIC SEPARATION—Apparatus for Electro-magnetic Separation. Ferdinand Steinert and Heinrich Stein, Cologne, Germany. (Brit. No. 6323 of 1908.)

MAGNETIC SEPARATORS—Improvements in, or Relating to Magnetic Separators. Harold Alcock, Doseley and Henry C. Simpson, Horsehay, Eng. (Brit. No. 18,855 of 1908.)

ORE-CONCENTRATOR. Emil Deister, Fort Wayne, Ind., assignor to the Deister Concentrator Company, a Corporation of Indiana. (U. S. No. 921,089 and 921,090; May 11, 1909.)

ORE-CONCENTRATING JIG AND COAL-WASHER. George C. Hackstaff, Denver, Colo. (U. S. No. 922,419; May 18, 1909.)

ORE SEPARATION—Process of Separation of Metals. Richard D. Divine, Chicago, Ill. (U. S. No. 921,372; May 11, 1909.)

SEPARATION PROCESS—Apparatus for Separating Solids from Liquids. Francis E. Elmore and Alexander S. Elmore, London, England. (U. S. No. 919,144; April 20, 1909.)

SEPARATOR—Improvements in, or Relating to the Separation of the Liquid and Solid Components of Wet Slimes or Ore Pulp. Horace G. Nichols, Ymir, B. C. (Brit. No. 2479 of 1908.)

TAILINGS DISPOSAL—Process of Disposing of Tailing-Sand and the Like. John F. Jackson, Houghton, Mich. (U. S. No. 918,054; April 13, 1909.)

METALLURGY—GENERAL

AGGLOMERATION PROCESS—Process for the Agglomeration of Small Finely Divided Ores. Antonin P. Foniakoff, St. Petersburg, Russia. (Brit. No. 4142 of 1908.)

BLAST-FURNACE OPERATION—Means for Running Off Slag from Blast-Furnaces. Joseph Marsden and Edward Pearson, South Bank, England. (U. S. No. 922,304; May 18, 1909.)

ELECTROLYTIC REDUCTION—Process of Reducing Ores. Frank J. Tone, Niagara Falls, N. Y. (U. S. No. 921,183; May 11, 1909.)

EXTRACTION — Process of Extracting Metal from Ore. Caleb G. Collins, Woodmere, N. Y., assignor to C. Amory Stevens, New York, N. Y. (U. S. No. 919,129; April 20, 1909.)

REDUCTION PROCESS—Process for Testing or Reducing Ores. Edwin P. Welch, Denver, Colo. (U. S. No. 919,663; April 27, 1909.)

ROASTING PROCESS—Process of Subjecting Materials to the Action of Air or Other Gases. John E. Greenawalt, Denver, Colo. (U. S. No. 921,645; May 11, 1909.)

SEPARATION—Process of Separating Metals from Ores. Pierre Germain, Paris, France. (U. S. No. 921,227; May 11, 1909.)

SULPHIDE-ORE TREATMENT—Improvements in, or Relating to the Treatment of Sulphide Ores or Products. Woldemar Hommel and the Metals Extraction Corporation, Ltd., London. (Brit. No. 6511 of 1908.)

MINING MACHINERY AND APPARATUS

BLASTING CARTRIDGES — Means for Waterproofing Blasting Cartridges. Axel Larsen, London. (Brit. No. 13,890 of 1908.)

BLASTING DEVICE. Charles P. McGregor, Pittsburg, Penn. (U. S. No. 921,144; May 11, 1909.)

BLASTING FUSES — Improvements in Waterproof Caps for Blasting and Mining Fuses. Thomas M. Daniels, Valdez, Alaska. (Brit. No. 7585 of 1908.)

CAGES—Improvements in or Applicable to Pit Cages and Hoists. John Stoney and Joseph Hindley, Tyldesley, Eng. (Brit. No. 26,776 of 1907.)

COAL OR STONE DRILLING MACHINE. Albert Ball, Claremont, N. H., assignor to Sullivan Machinery Company, Claremont, N. H., a Corporation of Maine. (U. S. No. 920,007; April 27, 1909.)

CONVEYING APPARATUS—Improvements in Apparatus for Conveying Material in Mines and Other Restricted Places. Archibald Robertson, Blairhill, Scotland. (Brit. No. 14,713 of 1908.)

CONVEYERS—Improved Mechanical Feed for Bucket Conveyers. John West, Southport, Eng. (Brit. No. 10,798 of 1908.)

DRILLS—Improvements in Mining Drills. Aaron E. Jennings and James W. Jennings, Central City, Ky. (Brit. No. 6234 of 1908.)

DRILLS — Improvements in Percussive Drills for Use in Machine or Hand Rock Drilling. James Harrington, Natal and Robert Parry, Johannesburg, Transvaal. (Brit. No. 5778 of 1908.)

MINING-CAR. Clayton M. Dibler, Jeannette, Penn., assignor of one-third to William Ruwcio and Joseph Torco, West Newton, Penn. (U. S. No. 920,033; April 27, 1909.)

MINER'S LAMP. Charles B. Rimmel, Carnegie, Penn., assignor of one-half to Peter J. Scheib, Carnegie, Penn. (U. S. No. 920,882; May 4, 1909.)

PROSPECTOR'S TOOL—Individual Intrenching or Prospector's Tool. Edgar T. Conley, U. S. Army. (U. S. No. 919,132; April 20, 1909.)

PUMP—Hydraulic Rotary Pump. Ira H. Spencer, Hartford, Conn., assignor to Organ Power Company, Hartford, Conn., a Corporation of Connecticut. (U. S. No. 917,971; April 13, 1909.)

ROCK DRILLS—Improvements in or Connected with Percussive Rock Drills. William C. Stephens, Carn Brea, Eng. (Brit. No. 7630 of 1908.)

ROCK DRILLS—Improvements Relating to Pneumatic Rock-Drills. Charles Christansen, Gelsenkirchen, Germany. (Brit. No. 7911 of 1908.)

ROCK DRILLS—Improvements in Percussive Rock-Drills. Holman Brothers, Camborne, Eng. (Brit. No. 6756 of 1908.)

ROCK DRILLS—Improvements in, or Relating to Rock Drills or Other Percussion Tools. Thomas Warsop, Nottingham, Eng. (Brit. No. 6094 of 1908.)

ROCK DRILL-SHARPENING MACHINE. Clark J. Smith, Ottumwa, Iowa, assignor to Hardsocg Wonder Drill Company, Incorporated, Ottumwa, Iowa. (U. S. No. 920,093; April 27, 1909.)

ROCK-DRILL SHARPENING AND SHAPING MACHINE. Clark J. Smith, Ottumwa, Iowa, assignor to Hardsocg Wonder Drill Company, Inc., Ottumwa, Iowa. (U. S. No. 919,969; April 27, 1909.)

SAFETY CATCH—Automatic Catch for Mining-Buckets, etc. Thomas C. Wright, Goldfield, Nev. (U. S. No. 922,375; May 18, 1909.)

SAFETY DEVICES — Improvements in Safety Devices for Lifts, Mine Cages and the Like. Albert Hodson, Lincoln, Ill. (Brit. No. 28,257 of 1908.)

SAFETY LAMPS—Improvements in Apparatus for Igniting Miners' Safety Lamps Especially Suitable for Use in Underground Workings and in Like Places. Ernest A. Hailwood, Morley, Eng. (Brit. No. 839 of 1909.)

SAFETY LAMPS—Improvements in or Connected with Locking Bolts of Miners' Safety Lamps. Harry B. Buckley, Batley, Eng. (Brit. No. 10,370 of 1908.)

SAFETY LAMP—Miner's Safety Lamp. Lewis W. Cogswell, James D. Abel and William A. Miller, Taylorville, Ill. (Brit. No. 9235 of 1908.)

TRANSPORTING APPARATUS for Mines. Alfred E. Davis, Johannesburg, Transvaal, assignor of three-fifths to Richard Meyer, Johannesburg, Transvaal, Francis Hastings Medhurst, London, England, and John Edgar Ferrar, Johannesburg, Transvaal. (U. S. No. 918,661; April 20, 1909.)

TUNNELING APPARATUS. Henry Japp, New York, N. Y., assignor to S. Pearson & Son, Inc., Long Island City, N. Y., a Corporation of New York. (U. S. No. 922,431; May 18, 1909.)

TUNNELING-MACHINE. Edward F. Terry, New York, N. Y., assignor to the Terry, Tench & Proctor Tunnel Machine Company, a Corporation of New York. (U. S. No. 917,974; April 13, 1909.)

VENTILATING-FAN for Mines. William D. Scott, Bridgeport, Ohio. (U. S. No. 921,744; May 18, 1909.)

METALLURGICAL MACHINERY AND APPARATUS

CRUCIBLE FURNACES—Improvement in Crucible Furnaces. William J. Holzapfel, Scottdale, Penn. (Brit. No. 12,342 of 1908.)

DISCHARGING FURNACES — Pneumatic Apparatus for Discharging Furnaces. Samuel E. Hitt, Pittsburg, Penn. (U. S. No. 916,314; Mar. 23, 1909.)

ELECTRIC FURNACE. Charles W. F. Gorrell, Ottawa, Ontario, Canada, assignor to Marcus Ruthenburg, Lockport, N. Y. (U. S. No. 916,548; March 30, 1909.)

ELECTRIC FURNACE. Hans Nathusius, Friedenshütte, near Morgenroth, Germany. (U. S. No. 920,078; April 27, 1909.)

ELECTROLYTIC REFINING—Acid-Proof Tank for the Electrolytic Refining of Metals. Anson G. Betts, Troy, N. Y. (U. S. No. 918,649; April 20, 1909.)

ELECTRIC SMELTING-FURNACE. Herbert C. Harrison, Exton, Penn. (U. S. No. 919,165; April 20, 1909.)

ELECTRIC SMELTING-FURNACE. Charles E. Wilson, Hood River, Ore. (U. S. No. 921,325; May 11, 1909.)

FURNACE for the Treatment of Metals. Wilhelm Schemmann and Jegor Bronn, Rombach, Germany. (U. S. No. 915,488; March 16, 1909.)

FURNACES FOR VOLATILE METALS—Improvements in, or Relating to Furnaces for Volatile Metals. Woldemar Hommel and the Metals Extraction Corporation, Ltd., London. (Brit. No. 27,018 of 1907.)

MATTE CAR—Revolving Matte-Car. Jas. C. Kilker, East Helena, Mont. (U. S. No. 921,999; May 18, 1909.)

MELTING-FURNACE. James E. Hewitt, Newark, N. J., assignor of one-fourth to Christian Franz, Newark, N. J. (U. S. No. 918,150; April 13, 1909.)

METALLURGICAL FURNACE — Door-Frame and Roof-Skewback for Furnaces. Jacob B. McKennan, Frank E. Parks and Samuel W. Gillin, Pueblo, Colo. (U. S. No. 918,356; April 13, 1909.)

METALLURGICAL FURNACES—Improvements in and Relating to Furnaces for Metallurgical Purposes. Peter Schmelzer, Metz, Germany. (Brit. No. 18,523 of 1908.)

NODULIZING—Improvements in Machinery for Making Blocks from Fine Ores, Blast Furnace Flue Dust and the Like. George P. Wallis, Horsforth, Eng. (Brit. No. 10,541 of 1908.)

ORE-ROASTING PLANT — Improvements in Coolers for Use in Connection with Ore-Roasting Plant. Thomas H. Webb, Poulton-le-Flyde, Eng. (Brit. No. 11,270 of 1908.)

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

T. A. Rickard is in New York and sails for England on May 29, where he will reside in future.

W. M. Brewer, of Victoria, B. C., is convalescent after a serious illness of several weeks' duration.

Major R. G. Edwards Leckie, of Sudbury, Ont., has been visiting the British Columbia coast cities.

J. P. Varian is engaged in examining properties in the Cobalt district, Ontario, for a New York syndicate.

George L. Fraser, manager of the Royal Collieries, Ltd., of Lethbridge, Alberta, is spending a vacation in eastern Canada.

E. G. Spilsbury, consulting engineer, will return to New York about June 1, after an absence of four weeks in Mexico.

Frank Jenkins, assistant manager of El Oro Mining and Railway Company, El Oro, Mexico, has gone to England to pass several months.

W. Rowland Cox, of Spurr & Cox (Inc.) is examining mines in northern Mexico for the American Smelting and Refining Company and other interests.

J. Parke Channing and J. A. Lewisohn were at Phœnix, B. C., recently, looking over the Dominion Copper Company's properties. They went thence to Vancouver.

Kezdick Smith has been appointed manager of the coal mines of the Vinton Colliery Company at Vintondale, Penn. He succeeds Charles L. Hower, who has resigned.

Charles M. Porcher has withdrawn from the firm of Pierson & Co., and will have charge of the eastern business of the Pittsburg Steel Company, with office in the Singer building, New York.

Pope Yeatman and Charles K. Lipman have been elected directors of the Guggenheimer Exploration Company to fill vacancies caused by the resignation of Robert Guggenheim and A. Chester Beatty.

John Hopp, the largest hydraulic placer gold operator in the Cariboo district of British Columbia, has gone to Barkerville to prepare for the ensuing season's mining after having spent the winter in Coast cities.

W. H. Trewartha-James, general manager, W. J. Watson, smelter manager, and J. W. Bryant, mining engineer, all of the Tyee Copper Company, recently paid a short visit to the Queen Charlotte islands, British Columbia.

Oscar A. Knox, lately general manager of the Octave Mining Company, Octave, Arizona, has sailed from San Francisco for Sydney, N. S. W., on his way to Western Australia, where he has a professional engagement.

Rex Taylor, recently assistant superintendent of the Kerr Lake mine, Cobalt, Ont., has been appointed manager of the Right-of-Way mine in place of Joseph Houston, who recently resigned to take charge of the Bonsall.

E. Knudsen, inventor of the well known copper-smelting process, who has been general manager at the mines at Sulitjelma, Sweden, has resigned that position to accept the general management for the Mitterberger Kupfer Aktiengesellschaft, at Ausserfeldten, Salzburg, Austria.

Prof. Henry Mace Payne, of West Virginia University, will sail from New York on the "Minneapolis" July 17, and will return in September. He intends to visit as many representative mines as possible in England, Wales, Belgium, Germany and France to study conditions there.

A personal item that appeared in the JOURNAL of May 8 to the effect that M. K. Rodgers, of Seattle, is about to enter upon the management of the Nickel Plate mine at Hedley, B. C., was incorrect. As the item came from an accredited and generally reliable correspondent, we had no reason to doubt it.

W. A. C. Pape has resigned his position as resident manager with the Metallic Alloys Company, to take effect June 1, after having designed, built and put into successful operation a dry grinding mill for the treatment of manganese ores, as well as a small smelter for the manufacture of manganese copper. His address will be Elkton, Va., until June.

Obituary

Jacob E. Ridgway died in Philadelphia, May 12, aged 84 years. He was a coal operator in the western part of Pennsylvania for many years, and opened mines in Cecil township, Washington county, which were the first in that district. Some years ago he sold his mines to the Pittsburg Coal Company, and retired from business.

Societies and Technical Schools

Colorado School of Mines—The Legislature of Colorado has appropriated $75,000 for an experimental ore dressing and metallurgical plant for this institution. Frank E. Shepard, president of the Denver Engineering Works Company, has been selected as consulting engineer for the installation of this plant.

American Chemical Society—The summer meeting of the American Chemical Society will, as already announced, be held in Detroit, Mich., June 29, to July 2, inclusive. The meetings of the sections and divisions will be held on June 29 and 30, and on July 2. On July 1 the members will visit the University of Michigan at Ann Arbor, where they will be the guests of the university for the day, returning to Detroit in the evening for the usual banquet.

Engineers' Society of Pennsylvania—A convention has been called, to be held at Harrisburg, June 9-11, for the purpose of completing the organization of a State society, to include all classes of engineers. Several hundred members of the engineering profession in its several branches, residing in various parts of Pennsylvania outside of Harrisburg, are already interested in forming an association for the purpose of holding annual conventions in the State. This association operates within the charter of the Engineers' Society of Pennsylvania, which now has a club house in Harrisburg.

American Institute of Chemical Engineers—A preliminary program has been issued for the semi-annual meeting, to be held at Brooklyn, N. Y., June 24-26. Among the papers promised for this meeting are the following: "The Utilization of Low Grade Fuels in the United States," O. K. Zwingenberger; "Creosote Oil from Coal Gas Tar," Dr. J. P. Sadtler; "Automatic Acid Egg," Richard K. Meade; "Some Experiments on Case-hardening of Steel with Gases," Dr. J. C. Olsen; "New York Metropolitan District as a Center for Great Industries," Dr. C. F. McKenna; "Methods of Clay Control," J. G. Dean.

Appalachian Engineering Association—At the meeting of this association, at Roanoke, Va., May 8, Mayor Cutchin made the address of welcome, to which Dr. I. C. White responded in behalf of the association. The balance of the morning session was devoted to the transaction of business. At the afternoon session Prof. L. S. Randolph read a paper on the "Water Power Possibilities of the South." The paper was discussed by Dr. White and others, and was followed by Capt. Baird Halberstadt upon "Recent Research in the Origin of Coal." The address was profusely illustrated with micro slides and an extended discussion of the coal origin problem ensued. F. H. La Baume then addressed the meeting. At the evening session Dr. Frank A. Wilder read a paper on "Properties and Uses of Mineral Gypsum," which was discussed.

Major William N. Page sent a paper on "The Organization and Engineering Difficulties of the Virginian Railway." The last paper was by M. M. Caldwell on the "Lead and Zinc Ores of Southwestern Virginia."

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Denver, Indianapolis, Salt Lake City, Goldfield and London

REVIEWS OF IMPORTANT EVENTS

San Francisco

May 22—While there is trouble at the Mother Lode properties at Jackson and other points in Amador county, over the new eight-hour law, several mines having quit work for the present, and there are similar difficulties in Tuolumne and Calaveras counties, yet the advent of the law has not produced the difficulty expected. The California branch of the Western Federation of Miners has been in session and the California Miners' Association has had a meeting in this city, yet there has been no very positive action by either of these bodies. The mine operators continue firm in the stand they took at the meeting two weeks since, which has been reported in these columns, and will insist that the eight hours means work "at the face" not from the time the men come to the shaft or tunnel. When this proposition has been rejected the mine has quit work notwithstanding the protest of the local miner's union. As a result, several important mines are for the present idle. A test suit will shortly be brought. The mine operators consider the new law to be unconstitutional and on the advice of the attorneys will contest it. There is, however, considerable unrest in the mining districts of the State and a great deal of uncertainty as to the outcome. If the law is finally enforced a number of low-grade properties on the Mother Lode and elsewhere must close down.

The Lassen Mining Company, of Hayden Hill, Lassen county, is about to resume operations after a shut-down of two years. After purchase of the properties it seems that one claim, into which the valuable vein was pitching, had a cloud on its title owing to defective probate proceedings. The company thought it was being "held up" and sooner than pay the price asked, quit work. As this is about the only productive mine in the county it will be good news to hear that it will soon be in operation again. There is quite an extensive plant on the property.

The Sixteen-to-One mine at Alleghany, Sierra county, still continues to hold the attention of mining men, owing to its phenomenal production in such short time and the fact that, thus far, there has been no end found to the productive ore shoot in the tunnel. Exceptionally high-grade ore continues to be taken out. The mine is owned by one man, E. H. Wilson, who has nothing to sell, and who is an experienced miner. He is not given to secrecy, but is willing that the information he has may be made public for the benefit of others in the same locality. He believes in legitimate mining and is carrying it on as he may well afford to. It is a noteworthy fact that notwithstanding the discoveries in this mine, the Tightner and others near Alleghany and Forest, in Sierra county, so far not one stock-selling company has been organized, though many hundreds of men have been attracted to the locality and are at work there. One man who was grubstaked in that section, while hunting for quartz, found unlocated placer ground from which he took $6000 worth of nuggets in a few weeks. In fact that region was formerly best known for its gravel deposits, most of them deep, and requiring drifting, though some surface gravels exist also. The county is one without railroads and has been neglected for some years. Its neighbor, Plumas county, is in the same fix as regards inaccessibility but now that such rich mines have been disclosed, access of population will mean much more vigorous prospecting of the mountain ranges.

The old Kenosha mine at Grass Valley is being reopened and unwatered. Some time since operations were commenced and then stopped but Geo. W. Root, the manager, has seen the stockholders in Kenosha, Wis., who are now willing to advance the funds. The plant is in good condition and retimbering the mouth of the shaft is being done.

Work has been started on the Banner Ridge Drift Mining Company's property near Banner Mountain, Nevada county. Machinery has been placed on the ground ready for future work. In past years many large nuggets have been taken out in this locality.

The Ocean Star mine in Washington district, Nevada county, owned by W. D. Cooley, has been bonded by E. C. Reed, of San Francisco, and the first payment made. There are two crosscut tunnels and a shaft on the property but more systematic developments are now to be made and hoisting works, mill, etc., will be put up. At the end of the 285-ft. tunnel a drift has been run in the face of which is a 6-ft. ledge carrying free gold.

The old Gold Bank mine at Forbestown, Butte county, which for many years was a large producer but which was closed down a few years since, has been bonded to responsible men who are to reopen it. Some other mines in the same district are also to be reopened this summer.

The Chamber of Commerce of Sacramento, is about to arrange rather a novel exhibition of the resources of the county for tourists and visitors from the Eastern States. Gold bearing soil is found near Folsom, and a few acres are to be laid off with a miner's cabin and miners in charge, so that visitors may have a chance to pan out some gold for themselves.

Skidoo, one of the new camps in Inyo county, had rather a hard time of it at first, but is now coming to its own. The big Skidoo company has its mill working now not only on its ore but that of leasers as well. No renewals of leases are being given. A number of "outside" mines with from two to four men at work are also producing. The Cashier is installing a 5-stamp mill. The leases on the Cocopah ground are turning out well. Some new mills are to be built and a number of 12-mule teams are hauling freight.

Butte

May 19—A number of stockholders of the Davis-Daly Copper Company have recently protested against the refusal of the company to receive delinquent payment of assessments on the stock. The directors are firm in their stand that failure to meet the last assessment means forfeiture of the stock to the underwriters. It is possible that some legal action may be taken by the dissatisfied stockholders. The annual meeting of stockholders of the East Butte company will be held on June 7, at Phœnix, Ariz.

With the recent strike of copper ore in the Black Rock mine of the Butte & Superior company, interest in other of the smaller companies in the camp is reviving. Several of these continued to operate throughout the hard times, among them being the Tuolumne, East Butte Extension and Butte & Balaklava. A number of those that were unable to keep going during the financial depression are now making preparations for resuming. At the Ophir mine the Butte Central Copper Company, successor to the Butte Central & Boston Copper Corporation, is making ready to start sinking within a few weeks. The shaft is now down 500 ft. Upon the results shown by the Butte & Superior properties will depend the future of many of the smaller concerns, among them being the Butte-Milwaukee, Butte & London and Raven companies.

Denver

May 21—Of the many rotary rock-boring machines for driving tunnels without the use of explosives now under consideration and construction, four which have made working tests have so far proved total failures. What is most regrettable is that the projectors of some of these unproved machines are advertising them widely and selling stock in them; in fact, they are exploiting the credulous public at the same time as the inventions. As regards the merits of them all, it would seem on general principles that it is folly trying to make a steel cutting head stand all the stress and do all the work of chipping out a 6- or 8-ft. diameter heading of solid rock for, say, 4 ft. in length at a time, when a round of small holes drilled and a charge of powder will blow it out at one shot. So far, however, the contentions in an article published in the issue of the JOURNAL of Nov. 23, 1907, have been fully sustained.

Much speculation is rife here as to the object of the late visit of John D. Ryan, president of the International Smelting and Refining Company, and his conference in Denver with the vice-president of the company, Dennis Sheedy. It is stated in the daily press here that they will establish a smelter in this State, but thus far there is no definite assurance that such is their intention.

Incidental with the withdrawal of lands in the Gore range by the reclamation service for irrigation purposes, is a long stretch of rugged, mountainous country, extending for 10 miles from Gore to Radium, on the Moffat road, that cannot possibly be reclaimed, irrigated, nor cultivated, but which is valuable for deposits of mica, limestone, lithographic stone and lodes of metalliferous ores. This action is in line with that of placing lands in the forest reserves which are devoid of trees, and is retarding the development of the mining industry and working a hardship on the State.

There is much satisfaction among the tungsten miners of Boulder county over Senator Guggenheim's amendment to the tariff bill, providing for a 15 per cent. duty on tungsten ore, and the statement that it will be accepted by the committee. It is stated that in 1907, Boulder county produced about 1200 tons of tungsten ore of an estimated gross value of half a million dollars. Last year, however, the panic and the falling off in the steel trade, knocked the bottom out of the tungsten mining industry in this State. It bids fair now to be revived again. The producers here state that there is hardly any profit in mining tungsten ore at less than $6 a unit. Boulder county tungsten is always in special demand by the manufacturers of steel, on account of being freer than any other from the heavy sulphides and oxides of iron, lead, zinc, arsenic and other impurities.

In Grand county, a discovery of very rich gold ore is reported from the foothills of the Gore range, 14 miles north of Kremmling, on the Moffat road. The country has been staked for miles.

In the deep drainage tunnel at Cripple Creek, on May 17, one man was instantly killed, and five seriously injured by an explosion of dynamite, caused by drilling into a missed shot. This is the first serious accident of the kind on this work.

At Stratton's Independence, over 80 men are engaged in surface leases. The whole of the ground on the outcrop of the various veins is completely covered, and much of the ore obtained is simply yellow clay, with gold contents varying from $10 to $50 per ton. In some places the lessees are down to the solid rock of the veins, and are finding bunches of very rich ore. It is currently reported that the monthly shipments from this extraordinary development of surface deposits varies from $15,000 to $20,000. In addition to this discovery, pay ore has recently been struck in the Washington vein, 300 ft. south of the main shaft, at a depth of 700 ft. from the surface. This is entirely in the granite. The ore shows calaverite and is in an altered granite matrix along and on each side of a shear zone, and is the first pay found in granite in Stratton's Independence. It is regarded as an important discovery and may lead to the development of a new mine.

Indianapolis

May 24—The Hungarian and Polish coal miners in the Jasonville district of Greene county have appealed to James Epperson, State mine inspector, for relief from what they declare to be the failure of the peace officers to protect them against riot, and the failure of the prosecuting attorney to bring proceedings against the rioters in the district who drove the foreigners from their homes. Mr. Epperson has taken the matter up with the attorney general and the governor; the latter has instructed the prosecutor to bring the matter to the attention of the grand jury. Complaint has also been made to the French Consul who likewise has demanded of the governor that the wrongs be redressed.

The trouble at the mine at which the ejected men were employed arose from charges made by the American miners that favors were being shown the foreigners, and that more work was being given them than could be procured by the native miners. A concerted movement was started which resulted in an attack upon the homes and camps of the foreigners and they were driven from the district, many leaving their household effects. They were fired into and they returned the fire, a number being injured on each side. The last legislature attempted to pass a law to prevent the invasion of the foreign miner but the bill failed.

Salt Lake City

May 21—The Bingham Construction Company, the company organized to operate the Mascotte tunnel enterprise at Bingham, has placed an order for 40 steel ore cars, weighing approximately 160,000 lb., to be used in transporting the ores of the Ohio Copper Company from its mines to the concentrating plant at the mouth of the Mascotte tunnel. The cars will have a capacity of 105 cu.ft., each, and the present order is only one fourth of the number that are to be placed in commission.

The annual meeting of the Silver King Coalition Mines Company was held in Salt Lake last week. The old board of directors and officers were reëlected without opposition. In his report, Engineer Charles P. Brooks estimated the developed ore reserves at approximately 130,000 tons. The shipments of crude ore and concentrates during the year amounted to 31,952 tons. This product sold for $1,345,000. Dividends amounting to $744,300 were paid and the rest of the money goes to operating expenses and additional surplus.

Section 41 of a circular issued by the commissioner of the general land office at Washington, and approved March 9, 1909, contains a ruling on the interpretation of the general mining laws that will vitally interest claims owners seeking to obtain patents. The Silver Shield company at Bingham, recently made application for patent on several claims and has had this new ruling brought to its attention. According to the new ruling, after a mining claim has been located, and before the owner can obtain a patent he will be required not only to prove that a lode has been discovered in the claim, but he must trace it out by actual work clear through the claim or claims sought to be patented. That done, he may concentrate his $500 worth of work for each claim, or remaining portion of it, at one point if he so desires. A strict enforcement of the new rule will mean that not many groups of mining claims, as such, will ever be patented again. It is not often that a ledge can be readily traced through a mining claim after its discovery on the surface and to expose it over the length of a group of claims would entail work that few men or companies would be capable of performing without loss of much time, and in some instances tremendous and unnecessary expenditures of money. In cases where companies and individuals locate on a lode and then take up additional claims to avoid encroachments from possible neighbors, the ruling will be a decided blow. It is not uncommon, after a vein has been located, or a discovery has been made, to locate a number of flanking claims without regard to whether they contain veins or not, but to head off possible litigation that arises so readily under our present mining laws.

The concentrating mill run in connection with the United States Smelting

Company's smelter at Bingham Junction will undergo a number of important changes to adapt it better to the concentration of Bingham ores. New features will be a regrinding plant and provision for electrostatic concentration of the zinc. The latter product will be shipped to zinc smelters in Kansas, except such portion as will be required by the company's process of making zinc oxide for neutralizing the acid in the smelter gases.

A deposit of a peculiar clay called "wonderite" that exists near Modena in Iron county is being mined for commercial purposes. The clay is soft and plastic but when it sets it becomes hard and will take a high polish exhibiting varied colors. The raw material is being bought by Salt Lake jewelers.

The new Utah Stock and Mining exchange was launched on May 18. Speeches were made by a number of prominent mining men in which they told of the field for a new exchange in Salt Lake. At the first formal call quotations were made on a large number of stocks nearly all of which are listed on the old exchange. During the opening day and the few succeeding days the trading has been good.

During the week ending May 14, the output of the Tintic mines comprised a total of 194 carloads as follows: In 50-ton cars, Ajax, 1; Bullion-Beck (leasers), 2; Centennial Eureka, 44; Eagle & Blue Bell (leasers), 1; Grand Central, 4; Mammoth, 14; Sioux Consolidated, 14; Victoria, 2; Yankee Consolidated, 2; in 20-ton cars, Brooklyn, 6; Black Jack, 3; Beck Tunnel, 4; Dragon Iron, 31; Colorado, 19; Iron Blossom, 37.

Goldfield, Nevada

May 20—The deal for the change in control of the Rawhide Coalition and the Rawhide Queen Mines Company, with a view to securing for the Rawhide camp a $300,000 railroad and a million-dollar mill at Walker lake has failed to go through.

From a willingness expressed by Charles W. Reed, president of the unfinished Rawhide Western Railway, to dispose of all the roadbeds which he put down between Walker lake and Rawhide, at an expense of about $75,000, it appears that the crucial reason why the deal did not go through was that there was no excuse nor necessity for the construction of the Rawhide Western railway. When the railroad was projected, it was the opinion of mine and mill operators that the only economical solution of the mill problem at Rawhide was to erect a large mill at Walker lake, 25 miles away, and transport the ores there for reduction. Recently, three experimental mills were erected in Rawhide, and all of these have been operated with success.

An unlimited supply of water has been struck on the flat, five miles south of Rawhide, and an underground lake discovered. Water is now being supplied faster than it can be utilized. The water question has been entirely solved in this way, and the water at Walker lake is not needed for milling.

The only question for the mills now to solve is that of fuel. The experimental mills at Rawhide are now using gasolene for power, all of which has to be transported across the desert by mule teams from the railroad station at Schurz, 25 miles away. Electric power companies, which are now supplying Nevada cities, have been examining into the Rawhide situation and offer practically unlimited electric power at $25 per horsepower. This eliminates the railroad proposition entirely.

London

May 15—At this season of the year there is a flood of annual reports coming from South Africa, the majority of the companies making up their accounts to the close of the year. The last year has been one of progress and most of the companies are able to show increased profits and to promise still further improvement in the future. Owing to the fall in working costs the ore reserves show in most cases a substantial increase, large tonnages formerly treated as unpayable now being classified as assets. The companies as a rule are liberal as regards the information given about the mine and the finances, but in one respect this is hardly the case and that is regarding the life of the mine. The numerous amalgamations that have been carried through in the last 12 months have made in many cases the life a subject of small importance. But there are still existent a fair number of mines that are nearing exhaustion, and in such cases more information as regards the date of exhaustion than is usually given appears wanted. Shareholders in the old established mines up to the present have had the satisfaction of being informed from time to time that the lives of their mines have been underestimated in the past. The reduction in working costs has completely altered the situation, and now reefs considered unpayable in the past are found to be workable, although, of course, the profits to be won in the future cannot be expected to compare with those in the past.

As examples of these extensions of life arising out of the altered conditions may be mentioned such companies as the Salisbury and the New Primose. The Salisbury mine was one that was a short time ago considered near the end of its tether, but owing to a recent valuation has suddenly been given a further six-years' lease of life. There are no doubt difficulties in estimating how long a mine may last and the experience of the past perhaps accounts for the dislike of directors and engineers to make estimates of life for fear that they may again make a bad shot. This is hardly, however, a valid excuse for leaving the subject alone, and it is due to the shareholders to have the best information available as to the remaining time that they may expect dividends.

The report of the Ferreira contains a paragraph that calls for special attention, as it indicates the adoption of a policy that appears certain to receive criticism. The paragraph referred to states that the directors have retained a large cash balance in view of the comparatively short life of the mine and the possibility of entering into fresh business for the prolongation of the company where immediate cash might be required. This points to an amalgamation with another neighboring mine, or to the investment of part of the profits of the company in a new mine. Whether the shareholders will agree to the directors speculating with the profits earned remains to be seen. It is a new departure and one to which the shareholders might reasonably take exception. Their capital is invested in a particular mine and by right the profits earned should be distributed and not a portion only on a standard fixed by past results as is the case now. Most shareholders would prefer to have the control of the profits in their own hands and select their own investments. The Rand Mines, Ltd., have also announced that some of the funds of the company are to be devoted to taking up fresh business should a favorable occasion arise. But the case of this company is somewhat different to the Ferreira mine, as the business of the company is largely that of a finance company, and it, therefore, stands on a different footing. There seems to be a desire on the part of those who control the Rand to prevent the extinction of companies or rather the extinction of shareholders, and this is to be effected either by the process of amalgamation, or by investing the profits in a new undertaking. Of these two processes the former seems the more legitimate. Indeed, it is questionable whether the second process is legitimate at all.

An exhibition of a new form of tube mill was given recently to a party of engineers by Fraser & Chalmers at their works at Erith. The tube itself is similar to the tubes now in use and the novelty consists in the alteration of the motion given to the tube which is attached to the trunnions not at the central axis, but off the center, so that the tube itself has an eccentric motion. By this means greater motion is given to the pebbles, and pulp within the tube. It is claimed that this arrangement increases considerably the efficiency of the machine. Tests are being conducted to determine the most advantageous degree of eccentricity, and it is proposed later to send out the machine to South Africa where its capability can be tested alongside a tube mill of the ordinary type.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alaska

SEWARD

The Alaska Central railway is rushing construction work to the coalfields of the Matanuska and Chickadoon, which are among the most important coal measures ever discovered in Alaska, there being wide seams of coal of a high-grade character. The government will maintain a naval coaling station on Resurrection bay within easy reach of the Alaska Central road. The site has already been approved by the Navy Department.

Arizona

COCHISE COUNTY

Arizona Gold Mines and Milling Company—The annual report shows that 600 ft. of tunnel work were done during seven months' operation last year. As soon as the power plant is equipped for oil-burning, operations will be continued.

Hilltop—A recent shipment of 15 tons of ore to the El Paso smelter gave returns of $40 per ton, net.

GRAHAM COUNTY

Shannon-Arizona Railway—Articles of incorporation were recently filed. The company expects to begin work on the proposed line from Clifton to Metcalf and bids for grading, blasting and tunnel work have been asked. Surveys have been completed. The line is 10 miles long, but will require excavations as follows: 100,000 cu.yd. solid rock; 7000 loose rock; 40,000 earth, and a 900-ft. tunnel.

Shannon Copper—Regular shipments are being made from this company's Copper Belle property at Gleason, Cochise county. Development work is being carried on at the Greenlee group near Clifton.

Detroit Copper—Judge Campbell, of the District Court, has set aside the $4000 verdict which was returned in the case of Hoefeld vs. The Detroit Copper Mining Company. This is one of 38 actions brought against the company by residents of Clifton, who claimed that the bursting of the company's dam caused them damage aggregating $250,000.

Missabe-Morenci Development Company—Articles of incorporation were recently filed by Dick Lakenau and associates. The company is organized to develop mining claims in Gold gulch between Morenci and Eagle pump.

Morenci Water Company—A new power house has been erected at the Eagle creek pump station.

Bonita—A short time ago a Mexican found three nuggets which he sold for $175. The gold was found near the mouth of Bonita creek. Development work shows the property to be of some worth, and a small plant is being operated with fair results.

California

AMADOR COUNTY

Defender—A new cyanide plant is being installed to work the tailings.

BUTTE COUNTY

Kentucky Ranch—The first clean-up of the new dredge has been made with satisfactory results.

Durgin—This old mine was recently incorporated by Los Angeles men. Preparations for working the property on an extensive scale are being made.

Gold Channel Dredging Company—This company was organized at Oroville by Los Angeles and Redlands people with the intention of working dredging lands near Oroville.

CALAVERAS COUNTY

Lloyd—The mine at Central Hill was sold at sheriff's sale to Arthur Jackson for $27,000. Mr. Jackson had obtained a judgment against the former owners, the Ophir Mining Company, for injuries received at the mine.

Reiner Mining Company—Electricity will be used for power in place of steam, as originally planned.

EL DORADO COUNTY

Mount Pleasant—A loan of $20,000 has been made with which to reopen the property, which has been idle for a year.

Morey—This mine, owned by Mrs. E. F. Morey at Grizzly Flat, is now producing. It has a three-stamp mill and power hoist. The ore is high grade.

Grainger—Numerous valuable nuggets are being taken out. They are found in a surface layer of decomposed granite which only covers the bedrock to 18 in. depth.

Lucero—At this property, S. W. Collins, superintendent, the showing on the 400 level of the Alpine is encouraging.

INYO COUNTY

Custer Consolidated—This company has been organized at Turlock to operate mines in the new district of Custer now being opened by N. O. Hultberg, of Turlock.

Pine Mountain—This group, owned by Heiskell, Wyat, Davies and others has been placed under bond to Salt Lake City men. These are gold-silver-lead claims.

KERN COUNTY

Amalie District—The Amalie mine is being operated by Rogers Brothers. A new company is about to take hold of the Zenda mine and reopen it. The Gold Peak company has not been operating lately.

MARIPOSA COUNTY

Ruth Pierce—This mine, near Hornitos, has been started up again, and the stamps are dropping on good ore.

Washington—This mine, in Hornitos district, one of the deepest in the county, is about to be sold to New York men. One shaft is 1600 ft. down.

MONO COUNTY

Snow Drift—McCarthy & Barnett have taken a lease on this mine, formerly the Booker, and will immediately commence work.

NEVADA COUNTY

American Mining and Development Company—An electric-light plant, compressor and drills have been purchased. The ditch was rebuilt. It is expected to upraise from the tunnel to the gravel channel in a few weeks.

Central Consolidated—Another strike of rich ore was made at Banner Mountain. It is supposed to be a continuation of the orebody found last month, only further south.

Norambagua—The heirs of the late Mr. Gilbert have decided to continue work and it will not be closed down as announced.

Oustomah—Frank M. Evans, manager, has started the 10-stamp mill on $40 ore.

PLUMAS COUNTY

Old Harry—In this mine, one of the Crown Point group near Quincy, Geo. McCall has found a small rich vein.

Colorado

LAKE COUNTY

Cleveland—This property is shipping 120 tons daily, the ore coming from the fourth and sixth levels. The crosscuts driven at the bottom of the shaft, 825 ft., to open the fissure vein north and south, are now passing through the parting quartzite.

Ibex—Lessees on No. 4 shaft of the Little Jonny, have encountered high-grade gold ore at the 1200-ft. level; the body as

far as developed, shows six feet of ore at the breast. The mine is shipping in the neighborhood of 7000 tons of different classes of ore per month.

Garbutt—A body of lead sulphide ore has been opened close to the Little Jonny. Daily shipments of 35 tons are being sent to the smelter.

Castle View—Arrangements are being made for the resumption of work. The same interests will also operate the Big Chief and Evelyn and all will be worked through the Castle View shaft. The properties contain lead and iron ore.

Chrysolite—Lessees are shipping 30 tons daily from a body of iron-silver ore, recently opened in the lower levels of this old Freyer hill property.

Yak Tunnel—Fifty feet from the breast of the bore, a crosscut has been started toward the Fortune grounds. Three shifts are working with machine drill and it is expected that within six weeks connection will be made. The breast of the tunnel is now approaching the New Monarch territory.

Hibschle—Bennet & Harris, who have a lease on the Coronado, have taken hold of the Hibschle property and will work it from the Coronado.

Dinero Tunnel—Connections have been made with the old shaft from the tunnel level, and within a short time all of the old workings will be drained of water, permitting the company to work the ore that was left there by the former owners.

Pyrenees—New pumps have been installed and are now raising water from the lower levels of this property on Iron hill.

Star of the West—Operations have continued on this property on Iron hill during the winter, though shipments have not been so heavy owing to the fact that much attention was devoted to development work.

Iron Silver—Work of installing the aërial tramway on Iron hill has been started.

Lackawanna Gulch—With the opening of spring, interest has been renewed in the Lackawanna gulch and many miners and prospectors are directing their attention thither. The ore of this section is gold bearing.

Georgia

Walker County

Pigeon Mountain Iron Company—This company, recently organized, has bought from E. M. Jones, of Chattanooga, Tenn., a tract of 3500 acres on Pigeon mountain, just south of the Tennessee line. The land contains three workable seams of iron ore, and the company intends to begin work at once on development; also on a spur to connect with the Chattanooga Southern and the Central Railroad of Georgia. The officers are: President, Joseph C. Haas, Montgomery, Ala.; vice-president, R. E. Watson, Atlanta, Ga.; secretary and treasurer, Edwin Haas.

Idaho

Shoshone County

Snowstorm—Ore shipments during April were made at the rate of 200 tons per day. This has been increased to 300 tons daily. The third dividend for the year was paid this month amounting to 3c. per share, or $45,000.

Orofino—It is reported that a 5-ft. vein of galena was recently encountered. The ore carries some silver.

Cuba—The main adit is in a distance of 630 ft., and has gained a depth of 350 ft. Lead ore has been encountered at this point.

Hecla—The annual report for 1908 was recently issued and states that during the year 76,586 tons of ore were extracted. Gross value, $569,805; cost of extraction, $233,136; cost of transportation and reduction, $193,146; cost of repairs, $34,723; net profits for the year, $108,799.

Coeur d'Alene Powder—An injunction has been issued by the District Court preventing the rebuilding of the plant which was recently destroyed by an explosion.

Indiana

Pike County

The Pure Oil Company is piping large quantities of oil from the Muran field and has begun the work of sinking additional wells nine miles south, where a new field has been discovered.

Sullivan County

The government experts sent from Pittsburg equipped with protective apparatus have, after a week's work extinguished the fire in the Keystone mine and the mine is now banked. They were able to live in the thick fumes and do effective work. There is little doubt that this experience will hasten the establishment of such a life-saving station in the Indiana coalfield.

Vanderburg County

The coal mines near Blackburn in this county—three in number—began operation this week after a suspension since the middle of January. These mines will give employment to several hundred men.

Michigan

Copper

Oneca—At the annual meeting of this company held recently the following directors were elected: John D. Cudahy, of Calumet, president; John Brooks, of Boston, secretary and treasurer; William F. Fitzgerald, George W. Towne and John C. Watson. Extensive exploratory work will be carried on during the summer under the direct supervision of John L. Harris.

Ojibway—Sinking has been resumed at No. 2 shaft 90 ft. below the 800-ft. level. The crosscut is approaching the lode No. 1 shaft, where sinking is suspended while the station at the 800-ft. level is being cut. The lode at this point lies in close proximity to the shaft. This company is gradually opening up good ground and will soon be in a position to maintain regular shipments.

Lake—This company has reached the fourth level in its shaft, a distance of 600 ft. from surface and a station is being cut preparatory to starting the level. At the third level the drift north is in about 75 ft. and is in ground carrying small mass and good stamp copper. The width of this lode has not yet been definitely determined, and it is planned to rig up a drill underground to ascertain its width instead of crosscutting through it.

Winona—It has been definitely decided to erect the stamp mill, which is to be owned jointly by this and the King Phillip Company, and actual work will be started in a day or so. This mill is to contain two heads and will be capable of handling about 1500 tons daily.

Superior—This company has reached the eleventh level at its No. 1 shaft and a crosscut started to cut the lode. Openings are being extended from the level above and good ground is being blocked out. Rock shipments of about 100 tons daily are made to the Atlantic mill. No. 2 shaft is being equipped with the hoisting and compressor plant that did service at No. 1 shaft.

Isle Royale—The shaft on the Baltic lode is temporarily bottomed at a depth of 400 ft. There is a gradual change in the character of the rock-formation as depth is obtained, the rock now resembling that opened at the Superior property.

Hancock—Sinking continues at this company's vertical shaft at a depth of 1600 ft. At the fifteenth level the large working crosscut that is to handle the rock tributary to No. 1 shaft, is approching the point where it will be intersected by the winze that is being sunk from the thirteenth level of No. 1 shaft. It is planned to establish levels at intervals of 100 ft. and work the ground down to this crosscut, which will be handled and hoisted at No. 2 shaft.

Mohawk—This company will begin the sinking of its new, or No. 6 shaft at once. A diamond drill hole was put down to test the overburden, encountering the Kearsarge lode at a depth of 200 ft. and showed the lode to be about 15 ft. wide and with the average copper content.

Minnesota

Iron—Vermilion Range

Section 30—No. 2 shaft at Ely, which was started 460 ft. from the old Shagawa shaft, has struck an orebody which ap-

pears to be of large size. Drifting and crosscutting have not yet reached the boundaries.

Missouri

JOPLIN ZINC-LEAD DISTRICT

Conqueror—A new tailings mill has been built to run the large pile of rich tailings that have been accumulating for a number of years.

Cock Robin—Operations have been resumed. A new mill has been built and good ore is being hoisted.

Jack Pot—This mine in Chitwood has started work on the John Jackson land.

Continental—This company is subleasing some of the lots on its Prosperity 40 acres. The sublessees will work the upper runs.

Lucky Budge—Labor troubles caused a shut down at the mine.

Lincoln—This mill has begun production at its mine north of Duenweg.

Kitty Mack—This company is operating on the Schifferdecker land west of Joplin and has 18 ft. of disseminated ore in 10 drill holes at 175 ft. depth. A 200-ton mill will be erected when development is further advanced. Z. J. Sheridan, of Joplin, is manager.

Lincoln—This company, near Duenweg, is installing Richards pulsator jigs in its new mill.

Louisville—This company has purchased the Big Fly mill and is moving it to its mine near Belville. Ed. Mallet is manager.

Sawyer—A new mill is being built on the lease on the Rex land, east of Joplin.

WAYNE COUNTY

St. Francis Iron and Land Company—As a result of a number of test-pits and borings development work is to be begun on a large tract of iron-ore land. A contract has been let for a washing plant. The company's office is at Greenville, Mo. James W. Van Dolan is president; C. P. Scrogin, secretary and treasurer.

Montana

BUTTE DISTRICT

Butte & Superior—The management states that the recent strike was made on the 1400-ft. level at a point about 100 ft. west of the shaft. Drifting has been done for 50 ft., and the indications are that the vein is over 10 ft. in width. A recent assay shows 14½ per cent. copper, 30 oz. silver and $2 gold per ton. The oreshoot dips to the east, thus indicating that its continuation will be found east of the shaft at a greater depth.

BROADWATER COUNTY

Ohio-Keating Gold Mining Company—This company has recently been organized by George M. Bourquin, W. R. Kirk and F. G. Goggin, of Butte. The company will have a capital stock of $500,000, divided into shares of the par value of $1 each. It is proposed to operate the Ohio group of claims, situated in the Radersburg district, near the Keating Gold Mining Company's property.

JEFFERSON COUNTY

Boston & Corbin—Raises are being run at two places in the three-compartment shaft. An air compressor and also a new hoist have been ordered, both of which will be electrically operated.

Corbin-Wicks Copper Company—At a special meeting of stockholders held in Butte last week, a plan to turn over all the property of the company to the newly organized Montana-Corbin Copper Company, was favorably voted upon. The exchange is made on the basis of 15 shares of Corbin-Wicks stock for one of the Montana-Corbin Copper Company. The properties to be transferred are the Hidden Treasure and Copper King patented quartz claims. The new company is a Maine corporation with a capital of $750,000, divided into 150,000 shares of the par value of $5.

Nevada

LINCOLN COUNTY

Pioche King—At a depth of 185 ft. a rich body of silver-lead ore has been encountered. The property adjoins the Prince Consolidated mine. John A. Kirby is general manager.

NYE COUNTY—BULLFROG

Montgomery-Shoshone—The monthly profits are approximately $20,000. New machinery is being added, which will increase the capacity of the mill about 20 per cent.

Mayflower—The total returns for April operations were $10,000 in bullion. The extraction was approximately 90 per cent.

NYE COUNTY—ROUND MOUNTAIN

Sphinx—Two separate and distinct veins of good milling ore have been encountered. M. J. Kiely is superintendent.

Jefferson—A tramway connecting the mine and mill is being built. Work on the mill is progressing rapidly.

Daisy—C. E. Johnson and associates have secured controlling interest. The company has been reorganized with C. E. Johnson, president and treasurer, and A. E. Johnson, vice-president.

NYE COUNTY—TONOPAH

Tonopah Mining—The net earnings for April, available for dividends, were $150,000.

McNamara—An ore contract has been closed with the Balaklala Copper Company, Shasta county, Cal. Shipments amount to 200 to 250 tons per week.

Ore Shipments—The weekly shipments are approximately: Tonopah company, 3350 tons; Belmont, 1000; Montana-Tonopah, 900; Midway, 100; McNamara, 250; West End Consolidated, 85 tons.

WHITE PINE COUNTY

Cumberland-Ely—Daily shipments amount to about 1500 tons. Drilling has been resumed on the Puritan claim.

Nevada Consolidated—The daily ore output is aproximately 3500 tons. The larger part of this ore is from the Copper Flat property.

North Carolina

CATAWBA COUNTY

Catawba Gold Mining Company—This company, operating the old Shuford mine, is striking rich ore, several thousand dollars worth of gold bullion having been shipped from the mine in the months of April and May.

DAVIDSON COUNTY

Silver Hill—This old mine, famous for its production of silver nuggets and lead ore, has been acquired by New England capitalists and who are preparing to resume operations.

FRANKLIN COUNTY

Portis—Two Overton gold placer washing machines are in operation with good results. A. J. Overton, of Salisbury, is manager.

MONTGOMERY COUNTY

Carter Mine—A cyanide plant is being erected by Claude Hafer, formerly connected with the Iola mine.

Dark Spring—This property, recently discovered, shows a belt of low-grade ore 30 ft. wide, with brown streaks that run high in gold. Ohio parties are erecting chilean mills on the property.

Iola—This old mine, purchased by W. Fleming, of New York, is now being operated under the management of M. B. Spaulding, formerly of Guanajuato, Mexico.

Oklahoma

CRAIG COUNTY

A lead and zinc deposit has been opened up near Bluejacket, fifteen miles north of Vinita. Recently a strike of lead and zinc was made near Wagoner. The Bluejacket strike has created great excitement and there is activity in leasing lands and preparations for extensive development are under way.

Tennessee

WHITE COUNTY

Clifty Consolidated Coal and Coke Company—This new company, owned by Massachusetts people, has bought 12,000 acres of land in the Caney Forks district, heretofore owned by the Clifty Coal and the Caney Fork Gulf companies. The latter is still undeveloped; on the Clifty tract there is a coal mine. The Consolidated company will enlarge the mine, put in electric haulage and other improve-

ments, increasing the capacity to 1200 tons of coal daily. E. M. Jones, Chattanooga, Tenn., is consulting engineer.

Utah

BEAVER COUNTY

Beaver Carbonate—A third shoot of lead-silver ore has been encountered at a point 415 ft. from the shaft on the 700-ft. level. The crosscut has been driven 34 ft. in ore and the hanging-wall has not been reached.

Horn Silver—A second shift has been put on at this property and in a few days the present force of 25 men will be doubled.

JUAB COUNTY

May Day—The shaft has now attained a depth of 1000 ft. and crosscuts will be run from this level to tap a large body of ore which is supposed to exist near the Godiva line.

Tintic Central—The electric hoist has been put in operation and the sinking of the shaft is now being rushed. Three shifts are employed on the work.

East Tintic District—The operators of the East Tintic district are building a wagon road from that district to Eureka. The new road will take a direct route, cutting off five miles from the present course, and will mean a great saving to the shippers in that section. The road will be completed in about one month.

SALT LAKE COUNTY

Columbus Consolidated—This mine at Alta made last week the record day for shipments since the present campaign was started. During that day 125 tons of ore were hauled to the sampler from the loading station on Tanner Flat.

Washington

The native coal will undergo a severe test by the government vessels of the Bering Sea and Arctic patrol this year, in an effort to substantiate the claim that the domestic product is equal to the British Columbia coal which has been used for many years. The Green River Coal Company is rushing work on its new coal bunkers with the view of early production for the market. New machinery is being installed.

KITTITAS COUNTY

Cle Elum-Roslyn Electric Railway and Power Company—The county commissioners granted a franchise to this company, which proposes to furnish transportation and power for the mines in the district.

LEWIS COUNTY

McCoy Creek—The company is installing a reduction plant and expects to have it in operation within three weeks.

SNOHOMISH COUNTY

Bonanza—Two miners were seriously injured by a premature blast. A short time ago George Pecola, manager, was overcome by bad air and lost his life.

Wayside—The mine is producing ore from the 850-ft. level at the rate of about one carload per week. A big flow of water has been encountered in the lower workings subsequent to the opening of the new orebodies.

Sauk District—Smith & Hanson have encountered the paystreak in their new working tunnel.

Wisconsin

ZINC-LEAD DISTRICT

Benton—The Calvert is obtaining the 100-ton mill equipment of the Hazel Green Mining Company. W. N. Smith, of Platteville, has charge of the Calvert. The Corr will replace the mill destroyed by fire last fall. A new shaft has opened up a rich vein of jack below the blanket vein of lead. A. L. Deerhammer, of Beloit, Wis., is president. The Lucky Twelve Company has purchased the Monarch mill and will remove this plant to its property on the Murphy land, five miles southeast of Benton. The Lake Superior is pumping out and will resume operations; only two cars of concentrates were turned out by the new mill when the property was closed down by the panic. The Wisconsin Zinc Company is drilling on the Alfred Grey farm, one mile west of Benton.

Platteville—The Big Four Mining Company has obtained a lease option on the Trego mine, formerly operated by the Platte Lead and Zinc Company. The 150-ton mill was purchased two months ago from the Platte company, which had forfeited its mining rights. The Wisconsin Zinc Company is moving the Royal mill to the Mitchell Hollow land. The Jarrett Lead and Zinc Company is building a 100-ton mill at St. Rose, nine miles south of Platteville. George Jarrett, of Platteville, is in charge. The Klar-Piquette Company, on May 25, pays its first dividend of 10 per cent. on $20,000 capital. The mine is turning out 10 to 17 tons of concentrates per day, which average 50 per cent. metallic zinc; an accumulated stock of 300 tons is in bins. The St. Rose company pays a dividend of 3 per cent., May 25, on $75,000 capital.

Canada

BRITISH COLUMBIA—BOUNDARY DISTRICT

British Columbia Copper Company—Engineers are surveying a line for a spur from the Columbia & Western railway between Eholt and Phœnix to this company's Jackpot mine, in Wellington camp, and thence to the No. 7, in Central camp, and the Lone Star and Washington, just across the International boundary line, the company being also largely interested in both these mines. There is a considerable tonnage of ore at all three mines and the provision of transportation facilities will allow its being shipped to the company's smelting works at Greenwood.

Granby Consolidated—The Gold Drop, one of this company's group of mines in Phœnix camp, is being prepared for resuming shipment of ore by about the middle of May.

Jewel—The West Kootenay Power and Light Company is extending its electric-power transmission system to the Jewel mine, Long Lake camp, where a gold-stamp mill is being erected, and in connection with which the Nichols' slimes-saving process is to be used.

BRITISH COLUMBIA—CARIBOO

E. I. West, of Horsefly, has returned from Oakland, Cal., to prepare for the ensuing season's hydraulic placer mining for gold. His hydraulicking plant, including a concentration appliance for saving the fine gold from the black sands characteristic of the district, will be installed on the south bank of Horsefly river about 30 miles from Harper's camp, where he has leased areas of gold-bearing gravels.

BRITISH COLUMBIA—CROW'S NEST PASS

The Canadian Western Mine Operators' Association has remained firm in its decision to decline consideration of any new proposals from District No. 18, United Mine Workers of America; insisting upon execution of the agreement arrived at about the end of March and afterward ratified by a majority of the miners directly concerned, but which District President Frank Sherman afterward refused to sign. After having been idle a month the men have become dissatisfied, having meanwhile learned that International President T. L. Lewis and other officials have intimated that no financial assistance may be expected from the international organization, because the local men having struck work after ratifying the agreement submitted to their vote. Now local officials have applied for a Board of Conciliation and Investigation under the "Industrial Disputes Investigation Act, 1907," known as the Lemieux Act; so there is prospect of a settlement.

BRITISH COLUMBIA—EAST KOOTENAY

Aurora—Six feet of ore, averaging about 36 oz. silver per ton and 39 per cent. lead, is showing in the face of the tunnel. The mine, which is situated across Moyie lake from the St. Eugene, is equipped with a small air compressor, steam driven.

BRITISH COLUMBIA—KASLO

Lucky Jim—Zinc ore is being shipped to the Mineral Point Zinc Company, Depue, Ill. The mine is leased to Hemenway & Loper, and G. W. Loper is in charge.

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore from Cobalt for the week ended May 15 were:

Buffalo, 42,990 lb.; Crown Reserve, 108,100; City of Cobalt, 59,000; La Rose, 131,200; McKinley-Darragh, 65,370; Nipissing, 62,060; O'Brien, 63,850; Temiskaming, 60,000; Temiskaming & Hudson Bay, 64,200; total, 656,770 pounds.

Beaver—An important strike was recently made at the 200-ft. level. The crosscut in which the strike was made commences 50 ft. east of the shaft. The vein is 10 to 12 in. wide and is said to carry over 3000 oz. silver to the ton. The significance of this find lies in the fact that in spite of extensive development work nothing of value has been found in the mine on the 100- or 150-ft. levels. Diamond drilling to strike the Temiskaming vein is being continued, the drill being put down at an angle of 45 deg. It is now 125 ft. below the surface.

Hargrave—The Jacobs or No. 3 Kerr Lake vein has been uncovered on the East Hargrave property, where it is 6 in. wide. About 400 ft. of the same vein have been stripped on the South Hargrave, on which the main workings are 235 ft. down.

La Rose—A new vein found on the surface of the Lawson property running at right angles to the main vein has been stripped for 28 ft. and shows solid ore 6 in. wide carrying much native silver.

Nipissing—During April ore of an estimated value of $149,739 was mined. Of a total of 291,629 oz. silver produced during the month 108,689 oz., or 37 per cent., came from the Kendall vein.

Chambers-Ferland—This company has purchased the Welsh claims in the Gowganda district, comprising 70 acres immediately adjoining the Bartlett property, on which some good discoveries have been made.

Dreadnought Mining Company—At a recent meeting of the shareholders of the Rothschild Mining Company, at New Liskeard, it was decided to transfer the holdings to the Dreadnought Mining Company, which is in process of organization in Montreal, with a capitalization of $1,000,000. A force of men will be set to work at once on the property under the direction of E. C. Kingswell.

Kerr Lake—Nearly all of the 84 tons of ore produced in April, which yielded about 200,000 oz. silver, came from No. 7 workings, including the new find known as the McDonald veins. On this vein a winze has been sunk 32 ft. from the 150-ft. level.

Mexico

Chihuahua

Zinc Smeltery—A State concession for the erection and operation of a zinc smeltery in the district of Iturbide, presumably at or near Chihuahua, has been granted to Donald B. Best and Luis F. Robinson,

Conchos Power Plant—It is reported that the newly perfected Mexican Northern Electric Company, of Canada, of which G. B. Greenwood, of Montreal, is president, is to shortly ecquire the Ginther-Creel-Cortazar power concession on the Conchos river, about 20 miles from Santa Rosalia, and erect a hydroelectric power plant. Mr. Greenwood was in Chihuahua recently.

Batopilas—The 1908 silver production of these mines totaled 839,865 oz., an increase of 8,328 oz. over 1907. The profits for 1908 were $57,445 as compared with $143,111 for 1907. The yield for the first four months of this year was over 750,000 fine ounces.

Iberri—A considerable body of shipping grade lead-silver ore has been opened at this Santa Eulalia mine. The owner is Juan F. Treviño and James Gasson is superintendent.

American Smelting and Refining Company—The monthly output of this company's Santa Eulalia mines is approximately 7000 tons. Upon the completion of the two aërial tramways the tonnage will be greatly increased. The ore is sent to the Chihuahua and El Paso plants.

Globe Mining Company—This New Orleans company represented by Joseph Meyer is developing properties in the Naica camp. It is likely that machinery will be installed soon.

Santa Maria—Recently 6 cars of high-grade copper-silver-lead ore were shipped to the Copper Queen smelter at Douglas, Ariz. This property is 25 miles from Sabinal, Chih., and is under the management of Wm. G. Gruber.

Rio Plata—Operations which were suspended for several weeks in April and May on account of the water shortage were resumed recently. The cyanide plant is scheduled for its initial regular run.

Guanajuato Consolidated—The general manager reports for the month of April, 1909, as follows: The mill ran 28½ days and crushed 6984 tons of dry ore; concentrates shipped to smelter 148 tons; estimated value of bullion produced $56,600; estimated value of concentrates $46,600; total gross value in products $103,200; less working expenses, including marketing of bullion and freight and treatment charges on concentrates shipped to smelter $69,500; estimated profit 33,700 pesos. Of this 11,000 pesos have been expended on development account. Amount of development work done, 406 feet.

Oaxaca

Taviche District—Recently a New York syndicate, headed by George W. Young and W. H. Ellis, purchased eight of the largest properties, comprising the Anita Grande, Las Pitallas, Hidden Treasure, La Buena, Admiral Dewey, Ampliacion, de Admiral Dewey, Gertrudis, and La Vereda. It is reported that 150-stamp mill will be installed. It will be operated by electricity and contain the latest improved machinery.

Two new mining companies were organized recently, one the Eliseo Gold-Silver Mining Company, with a capital of $5,000,000, and the other known as the Two Brothers Gold and Silver Mining Company, with a capital of $250,000. It is supposed that these companies are organized to operate the above-named properties.

Africa

Transvaal

The gold production of the Transvaal has already been reported at 607,101 oz. fine in April, and 2,395,433 oz. for the four months ended April 30. According to the report of the Chamber of Mines, the April output was from 1,676,000 tons of ore treated, giving an average of $7.14 per ton. For the four months the total tonnage was 6,588,856, the average per ton being $7.18. The labor report shows that on April 30 there were 162,901 negroes and 7734 Chinamen employed; an increase of 858 negroes during the month, but a decrease of 2263 Chinese. Since January, 1907, a total of 46,094 Chinese have been sent out of the Transvaal.

Asia

India—Mysore

Kolar Goldfield—Gold production in April is reported at 46,374 oz. bullion, an increase of 90 oz. over March, and of 767 oz. over April, 1908. For the four months ended April 30 the total was 181,476 oz. bullion in 1908, and 182,179 oz. in 1909; an increase of 703 oz. The bullion reported this year was equal to $2,489,074 or 163,961 oz. fine gold.

Australia

Queensland

Gold output in April is reported at 37,100 oz. from 52,700 tons of ore worked, and 300 oz. placer gold; a total of 37,400 oz., or $773,058 in value.

Europe

Austria—Galicia

Advices from Vienna report that the representatives of the Standard Oil Company have concluded an agreement with the Galician oil producers. The Standard, it is said, agrees to build a number of large reservoirs for the storage of oil, at a cost of about $1,400,000. The annual storage charges agreed upon will be 17.5 hellers, or about 3.5c. per 100 kg. for the first four years, which will be sufficient to defray the whole cost of the reservoirs. After the expiration of the first four years the storage charges will be reduced to 6 hellers, or 1.2c., per year. The Standard further binds itself to buy from the Austrian oil combination its whole output of benzine and crude oil at an agreed minimum price of 12 kroner (about $2.40) for benzine and 5 kroner (about $1) for oil.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, May 25—In the West the increase or improvement in the coal trade has not been checked, but continues slow. Little betterment is apparent from week to week, but if comparison is made with the corresponding period last year it is found that there has been a considerable advance. Steam coal is in better demand, but domestic trade is naturally slow at this period of the year. Car supply is good on almost all roads, and there is little or no complaint from shippers.

The Eastern bituminous trade is rather more quiet than that in the West. On the Seaboard the flurry over West Virginia coal as a disturbing element has subsided, although it may come up again at any time. The Norfolk & Western and the Chesapeake & Ohio seem to have made up their minds to keep the peace for the present. There is some speculation as to the future of the Virginian railway now that H. H. Rogers is dead, but it seems probable that a man of his business methods and habits of thought must have made some provision for carrying out his plans with this road.

In the anthracite trade there is nothing new. Accumulated stocks are being quietly worked off and many collieries are still running short time.

It is said that the Lackawanna directors are considering some plan for bringing their business into conformity with the recent decision on the commodities clause. It is not certain, however, whether a subsidiary company will be formed to operate the coal mines or whether some arrangement will be made for transferring the selling point of coal from tidewater and Lake Erie to the mines.

The cutting of rates at Springfield and other Massachusetts points on anthracite coal has, it is understood, been stopped, but the method or nature of the agreement does not seem to be generally known.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to May 15, short tons:

	1908.	1909.	Changes.
Anthracite	2,058,900	2,011,893	D. 47,007
Bituminous	12,016,199	13,034,442	I. 1,018,243
Coke	2,569,441	3,689,546	I. 1,120,105
Total	16,644,540	18,735,881	I. 2,091,341

Increase for the week was 143,595 tons. Total increase this year to date was 12.6 per cent.

New York

Anthracite

May 26—Trade continues quiet, with about the usual demand for consumption. There is a moderate putting in of stocks on the May discount which increases toward the end of the month when another 10c. will be taken off the discount. All sizes are in good supply.

Prices on domestic sizes are $4.35 for lump and $4.60 for egg, stove and chestnut, f.o.b. New York harbor. For steam sizes current quotations are $3.10@3.25 for pea, $2.35@2.50 for buckwheat, $1.70@2 for rice, $1.25@1.50 for barley, f.o.b. New York harbor.

Bituminous

The Seaboard bituminous trade, although still quiet, is showing some signs of improvement. A little more coal is being taken under contracts. The Far East is sending in a few orders. Business along the Sound remains steady, but not large. All-rail trade is about the same as it has been.

New York harbor continues to be rather a weak spot. Buyers are hunting for bargains, but not finding many. Prices are unchanged and there is little surplus coal, shippers still forwarding chiefly on orders.

Coastwise trade is a little better, but there are still plenty of boats and rates are unchanged. For large vessels from Philadelphia they are: To Boston, Salem and Portland, 55c.; Portsmouth, 70c.; Lynn, Newburyport and Bangor, 75c.; Providence, New Bedford and the Sound, 55c. per ton.

Birmingham

May 24—The coal trade in Alabama continues quiet. Very little coal is selling right now and the commercial producers are just as much down as the iron companies. But few companies in this State at present are operating their mines on full time. The coke demand is fairly good with prices holding up. Labor at the mines is complaining of the short work.

Chicago

May 24—The coal market shows increasing consumption of steam coals, with a lessening demand for lump to the advantage of fine coals. Screenings from Illinois and Indiana mines are the favorite fuel of many steam producers as summer comes on. Shipments of lump are too large just now.

Lump from Illinois and Indiana mines brings $1.75@2.25; run-of-mine, $1.65@1.75, and screenings $1.35@1.65.

Eastern coals find a steady market, but smokeless run-of-mine shows something of its old tendency to have bunched shipments at the railroad terminals, causing sales at low prices to escape demurrage. Pocahontas and New River smokeless sells at $3.20 for lump and $2.95 for run-of mine in general with run-of-mine occasionally bringing 10@20c. less. Hocking is still 25c. under the circular price of $3.15 on most sales, and sometimes sells for 30 or 40c. less. Gas coals are in light, steady demand, Youghiogheny ¾-in. bringing $3.15.

Domestic coals find light sales, bituminous being dull and anthracite inactive generally.

Cleveland

May 25—Selling of coal has been slow; buyers seem to be holding back, in the hope of getting coal cheap from sales made to avoid demurrage. The market is kept down by heavy shipments, and slack especially is in over-supply. Lake trade is slow, owing to trouble about vessels. The strike affects the smaller boats most wanted in the coal trade, much more than it does the larger vessels. Middle district run-of-mine can be had at $1 at mine. No. 8 run-of-mine 80@90c. at mine. Slack is purchasable at 50@60c. at mine.

Indianapolis

May 25—On the whole the coal trade for the past week has not been as satisfactory as expected. Shipments have been fairly good, but nothing has occurred to stiffen prices. The heaviest movement of Indiana coal is being directed over the Lake routes, although the Ohio river has moved a large tonnage. The factories and railroads are gradually increasing their buying. Orders for August and September delivery are expected to come in rapidly in the first two weeks of June. Retailers are holding off longer than usual, and the operators say the low prices have not appealed to them as expected. Most mines worked a little more than half time during the past week.

Pittsburg

May 25—No regular Lake shipments of coal will be made until after July 4. The movement thus far has been confined to

coal for the Canadian trade and some on railroad account. The Lake strike is not over, but the employers have the situation well in hand and believe they can man as many boats as required whenever they desire to do so. The regular market prices remain at $1.10 to manufacturers and other large buyers and $1.20 to retail dealers, for mine-run coal, but occasional sales are made at about $1 a ton, as formerly. The chief activity is in slack, which has firmed up to 60@65c. in price.

Connellsville Coke—The coke merger is expected to be put through, but there is still some question, as some of the prices asked are very high, from $3500 to $5500 an acre. It is computed on the outside that at 8000 tons of coke realized per acre, to carry out the operation and exhaust the coal in 15 years it would require about 90c. per ton of coke to be set aside to meet interest and refunding charges, computed at 6 per cent. and this is regarded as rather a heavy burden. Just what the options average on the whole, however, has not been ascertained.

The coke trade continues rather quiet, with prices unchanged at $1.40@1.60 for prompt furnace and $1.80@2 for contract furnace; $1.80@2 for prompt foundry and $1.90@2.25 for contract foundry coke, according to grade.

The *Courier* states the production in the Connellsville and lower Connellsville regions in the week ending May 15 at 252,485 tons, a gain of 8000 tons over the previous week, and reports shipments at 9179 cars; 3418 cars to the Pittsburg district, 4973 to points west of Pittsburg and 788 cars to points east of Connellsville. This is a gain of nearly 500 cars.

Coke Rates—The American Smelting and Refining Company has filed with the Interstate Commerce Commission a number of complaints of alleged overcharges on coke from the Connellsville region to Omaha and other western points.

Foreign Coal Trade

Austrian Coal—Coal production in Austria for the quarter ending March 31 was: Coal, 3,550,916; brown coal, 6,341,839; total, 9,892,755 metric tons. Coke made was 453,631 tons. Briquets made were 94,367 tons, of which 48,877 tons were made from brown coal, or lignite.

British Coal Exports—Exports of fuel from Great Britain, with coal sent abroad for the use of steamships in foreign trade, four months ended April 30, long tons:

	1908.	1909.	Changes.	
Coal	19,181,860	19,066,314	D.	115,546
Coke	362,223	353,624	D.	8,599
Briquets	490,552	470,957	D.	19,595
Total exports	20,034,635	19,890,895	D.	143,740
Steamer coal	6,244,036	6,085,543	D.	158,493
Total	26,278,671	25,976,438	D.	302,233

The larger exports this year were 3,649,902 tons to France, 3,011,667 tons to Italy and 2,466,807 tons to Germany.

French Coal Trade—Exports and imports of fuel in France, quarter ended March 31, metric tons:

Exports:	1908.	1909.	Changes.	
Coal	268,810	230,549	D.	38,261
Coke	35,010	38,942	I.	3,932
Briquets	24,750	45,195	I.	20,445
Imports:				
Coal	3,687,270	3,878,227	I.	190,957
Coke	463,810	491,962	I.	28,152
Briquets	213,340	252,700	I.	39,360

The chief imports are from Great Britain and Belgium. Exports include fuel furnished to steamships in foreign trade.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on May 15: Best Welsh steam, $3.90; seconds, $3.78; thirds, $3.54; dry coals, $3.66; best Monmouthshire, $3.48; seconds, $3.36; best small steam, $2.64; seconds, $2.46. All per long ton, f.o.b. shipping port. This is a decline of 6 to 12c. per ton.

Iron Trade Review

New York, May 26—A fair degree of activity continues in the iron and steel trades, although buying has fallen off somewhat from the recent high level. In part this is probably due to the fact that most manufacturers and immediate consumers have satisfied their needs for the present and have an abundance of material on hand; in part it is because the recent advances, though not great in themselves, have been sufficient to check some speculative business.

In finished material wire has had the greatest sale during the present month. This has resulted from the fact that the reduction in prices was held back much longer than in other branches, and when it was made there was consequently a rush to buy it. It is said that the American Steel and Wire Company took contracts during the first half of May for over 250,000 tons of wire and wire products. Structural steel sales for the same period are variously estimated from 175,000 up to 200,000 tons. The structural business is still coming in but the wire trade is pretty well over the rush.

Pig iron is in better demand than it has been. Both foundry and basic iron have sold well and from Pittsburg a good demand for bessemer pig is reported. Eastern furnaces are so far encouraged that their ideas of price are stiffer; from 25@50c. more is being asked in many cases for third-quarter delivery with an additional 25c. for fourth-quarter.

A feature of the market has been some large sales of heavy steel melting scrap. This would naturally go with the demand for basic pig.

Finished Iron and Steel Production—The American Iron and Steel Association reports the total make of rolled iron and steel in all forms in 1908 at 11,828,789 long tons, a decrease of 8,036,033 tons, or 40.4 per cent., from 1907. The production of nails was 10,662,972 kegs of 100 lb. each, a decrease of 1,068,072 kegs, or 10 per cent. The output of tinplates in 1908 was 1,203,075,000 lb., an increase of 49,978,000 lb., or 4.1 per cent.

Baltimore

May 24—Exports for the week included 3,418,700 lb. steel billets to Liverpool. Imports included 1105 tons spiegeleisen and 1691 tons ferromanganese from Great Britain; 5400 tons iron ore from Cuba.

Birmingham

May 24—There is some pig iron being sold in the Birmingham district at present but the activity is not as pronounced as it was last month. Quotations are not as strong as they have been, some sales being made here now at $11 for No. 2 foundry. Two or three companies in this district, however, are holding their product for $11.50 immediate delivery and not under $12 for delivery during the last quarter of the year. There is to be a curtailment in the production in the next few days, mostly through the necessity for repairs at furnaces. The Tennessee company has no furnaces in blast at Ensley at all but four are going at Bessemer. The Woodward Iron Company has two out of three furnaces at Woodward in blast. The Sloss Sheffield company has five out of seven furnaces going. Williamson furnace needs repairs and will shut down this week. The Central Foundry Company furnace at Holt is reported as needing some repairs as well as that of the Woodstock Iron Company at Anniston. Inquiries are being received here but the business is far from being as active as last month. There is much hope expressed for a better condition in the future.

The foundries and machine shops could stand an improvement. The cast-iron pipe makers are busy and are running their plants on full time. A shipment of 31 cars of pipe by the Central Foundry Company at Bessemer, to Arizona, was made last week.

Chicago

May 24—The pig-iron market continues quiet; the market for iron and steel products is active. This condition would seem to point to increased sales of pig iron soon, but the selling element is not hopeful in this respect, though holding firmly to present prices. Small lots, for delivery in one to four months hence, are the order of the day. The average consumer of iron does not wish to go into the future to any great extent.

Southern iron sells for $11.50@12 for delivery up to the end of the third quarter, or $15.85@16.35 Chicago. Northern holds at $16.50@17, with both Northern and Southern doubtless selling on some contracts at 50c. less than the minimum quo-

tation given. It is difficult to say at what price a large order could be placed, but it probably would not be much if at all below $11 Birmingham for Southern, or $16 for Northern.

Sales of iron and steel products are brisk, notably in railroad supplies and structural material. Coke is somewhat better for deliveries in the last half of the year, the best Connellsville bringing $4.70, as heretofore.

Cleveland

March 25—Quite a number of sales of iron ore are reported. Ore is coming down from Lake Superior rather slowly. Notwithstanding the strike, there are boats enough in commission to handle all the shipments; about 200 are in operation.

Pig Iron—The market is quiet, but many small sales are being made of foundry, with some good lots of basic pig. Prices are about on a basis of $15.25 for No. 2, Cleveland delivery.

Finished Material—Quite a number of small contracts for structural material and bars have been closed. Specifications on contracts are coming in more freely.

Philadelphia

May 26—The pig-iron market is stronger in tone, though prices have not advanced since last week. The chief activity is in basic, in which large contracts were placed, with more in negotiation. There is also more activity in several special brands which are selling at full asking prices. New inquiries are just to hand for pipe iron to cover the needs of pipe foundries. Forge iron is stronger in tone because of more inquiries but there have been no sales of consequence. The undertone of the entire market is stronger in view of enlarging demand from all quarters. No. 2X is quoted at $16; gray forge, $15, and basic, $15.25, asking price.

Steel Billets—Further ordering of billets in good sized lots is to be noted. Prices are firmer but not higher.

Bars—Best refined bars, at 1.35c., are selling better than for a month. A number of consumers have covered early summer requirements this week with orders calling for delivery in June.

Sheets—The change this week consists in the placing of orders by a few large consumers who have been buying piecemeal for months.

Pipes and Tubes—While the tone of the market is said to be stronger it is not because of large or numerous orders in this territory. Merchant pipe has been practically advanced. Tubes are quiet.

Plates—The greater activity in shipyards, car shops and lesser industries is helping to strengthen the plate industry. A large amount of business has been sent to the mills of this State.

Structural Material—The upward tendency is more apparent every day. All the structural mills are getting good business. Prices are stronger, the advance being genuine. Heavy orders for bridge, railroad and general building work are in sight. Manufacturers are at last holding their heads up.

Scrap—Heavy steel and heavy cast scrap are beginning to move after a long dullness, but at prices which do not lead holders to want to unload. They look for an advance on heavy steel and railroad. Other grades are weak and dull. Yard men are looking up supplies but are cautious as to what they pay.

Pittsburg

May 25—The advanced prices for bars, plates, shapes and wire products made in the past two or three weeks have not stopped buying, which is still of fair volume, although not as heavy as it was at the minimum. It is recognized that the mills made the advances largely because they feared buyers were placing orders too freely, and were contracting for larger tonnages than they could conveniently dispose of.

The demand for wire products has been fairly heavy since the advance of $2 per ton May 15, and some sellers are refusing to book as large tonnages as are offered. Present prices are $1.70 on nails, 1.50c. on plain wire, 1.70c. on painted barb wire and 2c. on galvanized barb wire. The mills are running practically full.

The prospect is for a somewhat quieter steel market in the next two or three months, as the buying has been heavy and has probably exceeded the current rate of consumption.

Pig Iron—The market has scored a sharp advance, prices of all grades being 25 to 50c. higher than a week ago. Sales of between 20,000 and 30,000 tons of prompt bessemer have been made in the past week, the first lot being one of 10,000 tons, taken by a prominent steel interest at $14.50, Valley. Other sales were of 4000- and 5000-ton lots, to ingot-mold foundries and steel works, and the price has advanced sharply to $15, Valley, as a minimum for prompt or third quarter, some sellers asking $15.25 and $15.50. Basic pig has firmed up after the large sales in the past few weeks, as low as $13.90, Valley, having been done, and the market is generally quoted at $14.50, although this price might be shaded 15 or 25c. per ton. Sales of foundry iron have been made at all the way from $14.50@14.75, Valley, according to brand, and the market is quoted at this range, while forge is $13.50@13.75, Valley. There has been a sharp advance in 50 per cent. ferrosilicon, due to a temporary scarcity, and prompt material has sold at as high as $70, Pittsburg, forward deliveries being also higher, with sales of several carloads at $63, Pittsburg.

Steel—The market continues uneventful as to sales, as consumers are well covered by term contracts, on which deliveries continue to increase. Billets are firm at $23, Pittsburg, and sheet-bars at $25.50, delivered Pittsburg, Wheeling, Youngstown, etc.

Sheets—The market is unchanged, demand being fairly good, but prices shaded, on attractive business, about $1 per ton on flat sheets and $2 per ton on corrugated material. The regularly quoted market, on ordinary carloads, is 2.25c. on black and 3.25c. on galvanized, 28 gage.

Ferromanganese—The market is a trifle firmer, it being difficult to do $40, Baltimore, even on attractive business, it being regularly quotable at about $41, Baltimore, or $42.95, Pittsburg.

Foreign Iron Trade

German Iron Production—The German Iron and Steel Union reports pig-iron production in April at 1,047,197 tons, being 25,919 tons less than in March. The average daily production increased, however, from 34,617 tons in March to 34,906 in April. For the four months ended April 30 the total make was, in metric tons:

	1908.	1909.	Changes.	
Foundry iron	774,913	744,765	D.	30,148
Forge iron.....	239,384	232,838	D.	6,546
Steel pig.....	351,671	359,572	I.	7,901
Bessemer pig.....	146,956	143,575	D.	3,381
Thomas(basic)pig	2,569,455	2,610,851	I.	41,396
Total.....	4,082,379	4,091,601	I.	9,222

Steel pig includes spiegeleisen, ferromanganese, ferrosilicon, and all similar alloys. The total output shows a slight gain for the first time this year.

Metal Markets

New York, May 26—The indications in most of the markets are of increasing demand, and in consequence there is a general upward tendency toward higher prices, though increases so far are moderate.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.	
Gold:				
April 1909..	$ 3,349,107	$ 6,337,994	Exp. $	2,988,887
" 1908..	2,561,197	14,476,341	Exp.	11,915,144
Year 1909..	44,316,626	15,507,382	Exp.	28,809,244
" 1908..	18,335,344	19,857,221	Imp.	1,521,877
Silver:				
Apri 1909..	4,952,251	4,073,504	Exp.	878,747
" 1908..	4,462,564	3,467,926	"	994,638
Year 1909..	19,426,181	14,526,722	"	4,899,459
" 1908..	17,048,851	14,298.582	"	2,750,269

Exports from the port of New York, week ended May 22: Gold, $6,589,739, to Paris, Berlin and Buenos Aires; silver, $850,633, chiefly to London. Imports: Gold, $139,552, from Australia and South America; silver, $67,834, from Central America and Mexico.

Foreign trade of the United States, four months ended April 30, as valued by the

Bureau of Statistics, Department of Commerce and Labor:

Merchandise:	1908.	1909.
Exports	$ 648,817,855	$ 547,257,162
Imports	346,301,599	477,325,021
Excess, exports	$ 302,516,256	$ 69,932,141
Add excess of exports, silver		4,899,459
Add excess of exports, gold		28,809,244
Total export balance		$ 103,640,844

The gold and silver movement will be found in the table at the head of this column.

The Treasury Department's estimate of money in the United States on May 1 is as follows:

	In Treasury.	In Circul'n.
Gold coin (inc. bullion in Treasury)	$ 193,501,336	$ 609,289,337
Gold certificates	42,089,580	804,609,289
Silver dollars	10,153,994	71,229,818
Silver certificates	5,965,203	476,581,797
Subsidiary silver	26,899,135	127,709,264
Treasury notes of 1890	8,481	4,320,519
U. S. notes	5,902,751	340,778,265
Nat. bank notes	25,263,392	662,144,83
Total	$309,783,872	$3,096,663,124

Population of the United States May 1, 1909, estimated at 88,687,000; circulation per capita, $34.92. Government deposits in national banks, not included in Treasury stocks, $59,381,047. Total circulation was $10,369,023 more than on May 1 last year.

Gold—There was a less active demand for gold and prices on the open market in London declined a little, bars being quoted at 77s. 9d. per oz. with American coin 76s. 4d. per oz. In New York the outward movement of gold still continues, both to Paris and to South America.

Platinum—Trade is reported as improving and sales are larger. Prices show little change, current quotations being $23@23.50 for refined platinum, $25.50 for hard metal, and $18.50@20.50 per oz. for scrap.

Our St. Petersburg correspondent writes under date of May 13: The government conference at St. Petersburg has not satisfied the smaller producers. It recommends that the export of crude platinum from Russia be prohibited, all refining to be done in the country. The proposition for a platinum trust has failed. The circulation of crude metal will be limited.

Quotations are unchanged. At Ekaterinburg the price is 4.50@5 rubles per zolotnik for crude metal, 83 per cent.; at St. Petersburg, 18,000@19,000 rubles per pood. These prices are equivalent to $16.92 and $18.13 per oz., average.

SILVER AND STERLING EXCHANGE

May.	20	21	22	24	25	26
New York	52⅞	52¾	52½	52⅝	52¾	52⅝
London	24 7/16	24¼	24½	24 7/16	24¼	24¼
Sterling Ex.	4.8780	4.8780	4.8780	4.8775	4.8780	4.8780

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Silver—The market during the past week has been very steady, with very small fluctuations. Purchases on China account occasionally have helped to sustain the price.

Exports of silver from London to the East, reported by Messrs Pixley & Abell, year to May 13:

	1908.	1909.	Changes.
India	£ 2,889,358	£1,553,400	D. £1,335,958
China	516,400	1,075,100	I. 558,700
Straits	90,200	82,800	D. 7,400
Total	£ 3,495,958	£2,711,300	D. £ 784,658

Imports for the week £3500 from Mexico and £200,500 from New York; total, £204,000.

Copper, Tin, Lead and Zinc

May.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
20	13⅛ @13⅜	12⅞ @13	59 1/16	29¼	4.30 @4.32½	4.25 @4.27½	5.00 @5.05
21	13⅛ @13⅜	12⅞ @13	59¾	29¼	4.30 @4.32½	4.25 @4.27½	5.00 @5.05
22	13⅛ @13⅜	12⅞ @13	....	29¼	4.30 @4.32½	4.25 @4.27½	5.02½ @5.07½
24	13¼ @13⅜	12⅞ @13⅛	59¾	29¼	4.30 @4.32½	4.25 @4.30	5.05 @5.10
25	13¼ @13⅜	13 @13¼	60	29⅜	4.30 @4.32½	4.25 @4.30	5.05 @5.10
26	13⅜ @13½	13 @13¼	61⅛	29⅜	4.30 @4.32½	4.25 @4.30	5.05 @5.10

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—A large business has been done during the past week, for home trade as well as for export. The consumption is steadily improving, and if looks as if the deliveries for May would exceed the production, thus reducing the stock. There has been a good demand, not only for early delivery, but also for shipment over the remainder of the year, but producers have been unwilling to sell ahead at present figures. Prices have advanced, the closing quotations being 13⅜@13½c. for Lake copper; 13@13¼c. for electrolytic in ingots, cakes and wirebars; 12⅞@13c. for casting copper. The average for casting copper has been 12⅞@13 cents.

On Thursday and Friday of last week the standard market was firm at £59 7s. 6d. for spot, and £60 for three months. This week it became very active. Large orders came to hand from all sides and prices quickly advanced, closing at £61 2s. 6d. for spot and £61 16s. 3d. for three months, an advance of almost £2 since the close of last Wednesday.

Copper sheets have been advanced ½c. to 17c. base for large lots. Full extras are charged, and higher prices for smaller quantities. Copper wire is 14½c. base, carload lots at mill. Business has been good.

For refined and manufactured sorts we quote: English tough, £64; best selected, £63@64; strong sheets, £75@77.

Tin—There has been a better tone in the London market, where the selling pressure, which was noticeable for some time past, seems to have been removed. Quotations have, however, not shown much change, but close firm at £132 12s. 6d. for spot and £133 12s. 6d. for three months.

Sellers in the domestic market have also been a good deal firmer, and especially spot material seems again to be concentrated in a few strong hands. The market closes steady at about 29⅜ cents.

Lead—There is a good demand for this article, particularly in the West, where prices have advanced, the close at St. Louis being quoted at 4.25@4.30, while at New York it remains unchanged at 4.30@4.32½ cents.

The John Wahl Commission Company telegraphs us from St. Louis, under date of May 26, that lead is strong and fairly active. Missouri brands are salable at 4.27½c. for both prompt and June delivery.

The London market has been quiet and somewhat lower, Spanish lead closing at £13 3s. 9d. and English lead at £13 7s. 6d.

Spelter—The galvanizing trade is constantly improving, and in consequence the consumption of spelter is steadily increasing. There has been a good demand during the week; prices are still advancing, St. Louis being quoted at 5.05@5.10c., and New York 5.20@5.25c. Sales for future delivery have been made at as high as 5.12½c., St. Louis.

Quotations for spelter in New York May 20 and 21 were 5.15@5.20c.; May 22 they were 5.17½@5.22½c.; May 24-26, inclusive, 5.20@5.25 cents.

The John Wahl Commission Company telegraphs us from St. Louis, under date of May 26, that spelter continues to advance. The latest sales are on a basis of 5.12½ cents.

The market in London is firm, closing quotations being unchanged at £22 for good ordinaries, £22 5s. for specials.

Base price of sheet zinc is 6¾c. per lb., f.o.b. La Salle-Peru, less 8 per cent. discount.

Other Metals

Antimony—The market has been dull, and prices in the absence of sales are rather nominal at 8⅜c. for Cookson's; 7⅞c. for U. S., and 7⅜@7⅝c. for outside brands.

Aluminum—Business is increasing a little. Prices are unchanged at 22@24c. base for No. 1 ingots; 31@32c. base for wire and 33@34c. base for sheets.

Quicksilver—Business is rather better, but prices are unchanged. New York quotation is $44.50 per flask of 75 lb. San Francisco, $44 for domestic and $42 for export orders. London quotation is £8 7s. 6d. per flask, with £8 2s. 6d. quoted by jobbers.

Nickel—Large lots, contract business, 40@50c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, four months ended April 30, figures in long tons, except quicksilver, which is in pounds:

Metals:	Imports.	Exports.	Excess.
Copper, long tons	39,126	23,802	Imp. 15,324
Copper, 1908....	50,704	21,394	Imp. 29,310
Tin, long tons....	13,018	13,289	Exp. 271
Tin, 1908.....	16,200	13,430	Imp. 2,770
Lead, short tons.	73,461	14,712	Imp. 58,749
Lead, 1908.....	81,241	18,322	Imp. 62,919
Spelter, sh. tons.	36,492	2,082	Imp. 34,410
Spelter, 1908....	35,137	2,438	Imp. 32,699
Quicksilver, lb...	1,282,063	356,226	Imp. 925,837
Quicksilver, '08	1,691,733	633,255	Imp. 1,058,478
Ores:			
Tin ore and con.	7,445	.....	Imp. 7,445
Tin ore, 1908...	9,421	.....	Imp. 9,421
Pyrites.....	275,084	.....	Imp. 275,084
Pyrites, 1908...	301,777	.....	Imp. 301,777

Copper totals include metallic contents of ore and matte. Exports include re-exports of foreign material. Of the imports in 1909 the United States furnished 128 tons copper matte, 7881 tons fine copper and 11,946 tons lead.

British Iron Trade—Exports and imports of iron and steel in Great Britain four months ended April 30 were valued as follows:

	Exports.	Imports.	Excess.
Iron and steel	£12,087,320	£ 2,503,331	Ex. £ 9,583,989
Machinery...	9,180,589	1,544,038	Ex. 7,636,551
New ships....	2,380,848	.....	Ex. 2,380,848
Total..... ..	£23,648,757	£ 4,047,369	Ex. £19,601,388
Total, 1908..	26,392,140	4,311,580	Ex. 22,080,560

Total decrease in exports, £2,743,383, or 11.6 per cent.; decrease in imports, £264,211, or 6.1 per cent. The quantities of iron and steel were, in long tons:

	1908.	1909.	Changes.
Exports.....	1,357,512	1,292,661	D. 64,851
Imports.....	342,136	374,595	I. 32,459

The increased tonnage of imports was mainly in blooms, billets and other half-finished material.

Zinc and Lead Ore Markets

Joplin, Mo., May 22—Zinc sulphide ore sold as high as $43 per ton, and the base price was advanced to $41.50 for 60 per cent. zinc, with an unconfirmed rumor of a $42 base. Offerings ranged down to a $38 base for heads and some slimes sold as low as $36@37 base. Zinc silicate ore sold at $14@24 per ton, the base offerings having about the same wide range, with a stronger demand for these ores the latter part of the week. The average price, all grades, was $37.44. Lead ore sold as high as $58 with small lots selling under $57. The average price, all grades, was $57.38 per ton.

Zinc prices began advancing Wednesday and the market continued feverish to the end of the week, when the offerings of $41.50 base were made for delivery next week, with larger demand from several smelters.

SHIPMENTS, WEEK ENDED MAY 22.

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,877,150	1,380,580	$117,233
Joplin.....	2,595,640	208,080	57,478
Miami.....	861,790	151,410	17,288
Duenweg.....	685,390	108,460	15,184
Galena.....	659,300	64,060	14,416
Prosperity.....	656,130	38,530	14,229
Badger.....	622,250	35,070	13,448
Alba-Neck.....	544,020	.....	10,880
Aurora.....	580,240	.....	8,984
Carthage.....	374,540	.....	7,490
Spurgeon.....	247,790	82,440	6,504
Granby.....	428,720	18,400	5,509
Oronogo.....	345,280	6,760	4,878
Quapaw.....	232,390	.....	4,415
Zincite.....	39,030	46,350	2,100
Carl Junction.....	87,630	.....	1,752
Sarcoxie.....	46,310	.....	926
Totals	12,883,600	2,140,140	$302,714
21 weeks.....	237,916,190	38,788,410	$5,328,196
Zinc value, the week,	$241,292;	21 weeks,	$4,302,834
Lead value, the week,	61,422;	21 weeks,	1,025,362

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January.....	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February....	36.63	36.94	34.92	34.37	49.72	50.50
March.....	36.19	37.40	34.19	34.71	49.90	50.82
April.....	35.40	38.63	34.08	37.01	52.47	55.63
May.....	34.19	.....	33.39	.....	56.05	.....
June.....	33.06	.....	32.07	.....	60.48	.....
July.....	34.55	.....	31.67	.....	59.90	.....
August.....	36.53	.....	33.42	.....	60.34	.....
September..	37.63	.....	34.44	.....	54.59	.....
October.....	35.95	.....	33.28	.....	52.63	.....
November..	39.13	.....	35.02	.....	54.53	.....
December..	42.75	.....	39.63	.....	49.68	.....
Year.....	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., May 22—The highest price paid this week for zinc ore was $43; the base price advanced from $39 to $40.50 per ton at the week end. For 80 per cent. lead ore $55 per ton was paid.

SHIPMENTS, WEEK ENDED MAY 22.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville.....	596,235	.....	242,300
Strawbridge.....	480,000	.....	.....
Cuba City.....	387,335	88,775	143,000
Benton.....	328,490	.....	.....
Hazel Green.....	302,400	.....	.....
Galena.....	264,000	.....	.....
Livingston.....	160,000	.....	.....
Rewey.....	61,000	.....	.....
Total.....	2,579,460	88,775	385,300
Year to May 22.....	42,163,214	1,486,435	3,509,000

On account of the condition of the wires, Highland, Linden and Harker are not reported. In addition to the above there was shipped to the American Zinc Ore Separating Company 410,770 lb., and to the Joplin Separator Works 214,000 lb. zinc concentrates.

Chemicals

New York, May 26—A slight improvement begins to show itself in the market, rather more on contract than on current business.

Copper Sulphate—Sales are about the same and business is done at last week's prices—4.22½ per 100 lb. for carload lots, and 4.47½ per 100 lb. for smaller parcels.

Arsenic—Sales have been fair with quotations a trifle lower, at 2¾@2⅞c. per lb. for white arsenic.

Nitrate of Soda—The market for this article continues good and prices have advanced a little, 2.25c. being asked for spot nitrate and 2.15c. for future positions.

Potassium Salts—Exports of potassium salts from Germany for the quarter ended March 31 were, in metric tons:

	1908.	1909.	Changes.
Kainit, kiesenrit, etc...	147,129	173,988	I. 26,859
Potassium chloride.....	27,744	41,841	I. 14,097
Potassium sulphate....	9,560	13,895	I. 4,335
Pot.-magnesium sul....	38,557	30,580	D. 7,977
Total	222,990	260,304	I. 37,314

Of the exports this year in all 84,986 tons went to the United States.

Fertilizers—It is reported that the combination of independent fertilizer manufacturers may fail, J. P. Morgan & Co. having withdrawn the financial support expected from them.

Mining Stocks

New York, May 26—The general stock market has been less active than for some time and inclined to be irregular. It has been a traders' market, with comparatively little outside influence and few disturbing factors. Consequently, it has moved up and down in a rather irregular way and has shown no very definite tendency. At best there has been rather a cessation in the bull movement, but without any general break. The most marked feature has been the great strength of Steel Corporation stocks, which have continued to rise, the common stock advancing to record quotations. It is to be noted that J. P. Morgan, Jr., has been chosen a director of the Steel Corporation to succeed H. H. Rogers—not a Standard Oil man, as was expected.

There was one sale during the week of Homestake, of South Dakota, 100 shares changing hands at $92 per share.

On the Curb the copper stocks have shown small fluctuations, but no important changes. The movement was divided, some stocks losing a little, while others gained. Sales were only moderate. The Nevada gold stocks are improving in

price and demand, while Cobalt stocks did a moderate business.

Boston, May 25—North Butte has again been the market feature; continued liquidation and bear manipulation have resulted in putting a quietus on the general mining share market. It broke from $62 to $55.50, recovered to above $59, and fell back again to under $57. The public is in the dark as to the actual condition of the company, but the best belief is that the property has fallen behind. The declaration of a $6 dividend by Calumet & Hecla lends encouragement to the situation, as it is a small increase over recent payments. Calumet dividends have always been in multiples of $5, so that this rate is an unusual one.

Amalgamated has fluctuated between $82 and $84.50, but closes about the same as a week ago. There is no pressure to sell mining stocks and the odds are that prices will work higher. United States Smelting has had a $3 advance to $50.50, while the preferred is also up to $1.75 to $50. There is pool work in this stock and these movements are facilitated by reason of the fact that all discords in the management are ended. United States Coal and Oil, the management being the same as United States Mining, has advanced from $31.50 to $34.. Butte Coalition and Parrot have been strong spots.

Prices on the Curb have been firm for the higher-priced issues. Yukon has risen $1 to $5.25. Helvetia had a good advance also.

STOCK QUOTATIONS

NEW YORK	May 26
Name of Comp.	Clg.
Alaska Mine	.62
Amalgamated	84⅛
Anaconda	50⅞
Balaklala	‡2
British Col. Cop.	7½
Buffalo Mines	‡3½
Butte Coalition	26⅝
Colonial Silver	¼
Cum. Ely Mining	8 1/16
Davis-Daly	5⅜
Dominion Cop.	.07
Douglas Copper	2⅛
El Rayo	2
Florence	3 1/16
Foster Cobalt	‡.32
Furnace Creek	.10
Giroux	7⅝
Gold Hill	‡⅛
Goldfield Con	7⅞
Granby	104
Greene Gold	½
Greene G. & S.	9
Guanajuato	‡1⅝
Guggen. Exp.	195
Hanapah	‡.15
Kerr Lake	8
McKinley Dar.	.90
Miami Copper	14⅝
Micmac	¾
Mines Co. of Am.	1/16
Mitchell Mining	‡⅜
Mont. Sho. C.	‡11 1/16
Nev. Utah M. & S.	2 1/16
Newhouse M. & S.	2⅛
Nipissing Mines	10⅝
Old Hundred	⅜
Silver Queen	.37
Stewart	1/16
Tennessee Cop'r.	41¼
Tri-Bullion	⅞
Union Copper	1¼
Utah Apex	6½
Utah Copper	51
Yukon Gold	5 3/16

BOSTON	May 26
Name of Comp.	Clg.
Adventure	9¼
Allouez	‡39½
Am. Zinc	‡25
Arcadian	5
Arizona Com.	44⅛
Atlantic	9¾
Boston Con.	15¾
Calumet & Ariz.	104
Calumet & Hecla	635
Centennial	31⅛
Copper Range	81
Daly-West	8⅞
East Butte*	13⅛
Franklin	15
Greene—Can	10¼
Hancock	10⅛
Isle Royal	‡27
Keweenaw	3½
La Salle	14½
Mass	14⅞
Michigan	10½
Mohawk	.66
Nevada	22½
North Butte	57⅛
Ojibway	‡11
Old Colony	‡.60
Old Dominion	55
Osceola	135
Parrot	35¼
Quincy	90
Rhode Island	14¾
Shannon	16¼
Superior	40⅛
Superior & Bost.	16⅝
Superior & Pitts.	14½
Tamarack	‡70
Trinity	13¾
U. S. Smg. & Ref.	50
U.S. Sm. & Re., pd.	49¾
Utah Con.	40¾
Victoria	‡4⅞
Winona	5¾
Wolverine	‡147
Wyandotte	2¾

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	39⅛
Am. Smelt. & Ref.	93⅛
Am.Sm. & Ref., pf	109¾
Colo. Fuel & Iron.	41⅛
Federal M. & S.,pf.	‡92
National Lead	87
National Lead, pf.	105
Pittsburg Coal	12¼
Republic I. & S.	29⅞
Republic I.& S.,pf.	91
Sloss-Sheffield	83
Standard Oil	673
U. S. Steel	60⅞
U. S. Steel, pf.	119⅛
Va. Car. Chem.	50¼

BOSTON CURB	Low.
Ahmeek	‡150
Black Mt.	‡.85
Chemung	16¼
Globe Con	‡4½
Helvetia	5 5/16
North Lake	‡7⅛
Ray Central	3⅛
Ray Con	17¾
San Antonio	11¾

ST. LOUIS	May 22	
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.07	.05
Center Cr'k	2.00	1.50
Cent.C.& C.	81.00	80.00
C.C. & C. pd.	80.00	79.00
Cent. Oil	110.00	100.00
Columbia	7.00	5.00
Con. Coal	20.00	19.00
Doe Run	110.00	100.00
Gra. Bimet.	.25	.20
St. Joe	12.50	11.00

LONDON	May 26
Name of Com.	Clg.
Dolores	£1 5s 0d
Stratton'sInd.	0 3 1½
Camp Bird	1 2 9
Esperanza	2 18 9
Tomboy	1 2 6
El Oro	1 6 3
Oroville	0 13 9

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. May 26.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Belcher	.50
Best & Belcher	35
Caledonia	09
Chollar	.06
Comstock	31
Con. Cal. & Va	.66
Crown Point	.50
Exchequer	.25
Gould & Curry	.08
Hale & Norcross	.20
Mexican	.79
Ophir	1.20
Overman	.14
Potosi	13
Savage	.19
Sierra Nevada	.28
Union	.31
Utah	.04
Yellow Jacket	.56
TONOPAH STOCKS	
Belmont	.78
Extension	.49
Golden Anchor	...
Jim Butler	.15
MacNamara	.24
Midway	24
Montana	70
North Star	02
Tono'h Mine of N.	7 18¾
West End Con	29
GOLDFI'D STOCKS	
Adams	02
Atlanta	16
Blue Bell	04
Booth	16
Columbia Mt.	.10
Comb. Frac.	.74
Con. Red Top	03
Cracker Jack	03
Dia'dfield B. B. C.	05
Goldfield Belmont	04
Goldfield Daisy	31½
Great Bend	09
Jumbo Extension	14
Kendall	.05
Lone Star	04
May Queen	.04
Oro	08
Red Hill	.08
Roanoke	...
Sandstorm	.10

Name of Comp	Clg.
Silver Pick	.18
St. Ives	.10
Triangle	.01½
BULLFROG STOCKS	
Gibraltar	04
Homestake King.	.01
Mont. Shoshone C.	1.93¾
Tramp Cons	06
MISCELLANEOUS	
Bonnie Clare	...
Lee Gold Grotto	...
Nevada Hills	1 31½
Nevada Smelting	.87½
Nevada Wonder	60
Nevada-Utah	2 25
Penn-Wyoming	.05
Pittsburgh S. Pk.	.52
Rawhide Caol't'n.	...
Round Mt. Sphinx	.09

COLO. SPRINGS May 21

Name of Comp.	Clg.
Acacia	.06¾
Black Bell	....
C. C. Con	‡.03
Dante	.06
Doctor	‡.09
Elkton	.63½
El Paso	.47⅞
Findlay	.15
Gold Dollar	.11¾
Gold Sovereign	.03
Isabella	.20½
Jack Pot	‡.07½
Jennie Sample	.07
Jerry Johnson	‡.05¾
Mary McKinney	39
Pharmacist	‡.03
Portland	.87¾
Un. Gold Mines	.06
Vindicator	.57½
Work	‡.06¾

Assessments

Company.	Delinq.	Sale.	Amt.
Blue Wing, Ida	May 8	June 5	$0.005
Carney Copper, Ida	Mar. 25	May 1	0.003
Confidence, Nev.	May 18	June 8	0.20
Con. Imperial, Nev.	May 26	June 17	0.01
Dalton M. & M., Utah	May 26	June 9	0.00½
Echo, Ida	May 1	June 1	0.002
Elk M. & M., Ida	Apr. 20	May 20	0.001
Exchequer, Nev	May 5	May 26	0.05
Hecla M. & M., Utah	May 15	June 14	0.05
Imlay, Nev	Apr. 6	Apr. 28	0.03
Julia Con., Nev.	May 24	June 17	0.03
Laclede, Ida	Apr. 7	May 1	0.003
Mexican, Nev	Apr. 8	Apr. 29	0.10
Nev. Superior	Apr. 10	May 1	0.07½
Palmyra G. & C., Utah	June 11	June 30	0.001
Reindeer C. & G., Ida	Apr. 28	May 28	0.005
Savage, Nev.	Apr. 8	May 5	0.10
Sierra Nevada, Nev.	May 4	May 25	0.10
Uintah Treas. Hill, Utah	May 20	June 9	0.01
Utah, Nev.	May 6	May 27	0.03
Yerington Gold, Nev.	Apr. 8	May 12	0.005

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1908.	1909.	1908.	1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	50.468	25.570	23.227
April	55.505	51.428	25.133	23.708
May	52.795	.....	24.377	.....
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.766	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1908.	1909.	1908.	1909.	1908.	1909.
January	13.726	13.893	13.901	14.280	62.386	57.688
February	12.905	12 949	13.098	13.295	58.786	61.198
March	12.704	12.387	12.875	12.826	58.761	56.231
April	12.743	12.56½	12.928	12.93¾	58.331	57.363
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28 060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.577	28.727	September	28.815	.....
April	31.702	29.445	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. Year.	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis	London.	
	1908.	1909.	1909.	1908.	1909.
January	3.691	4.175	4.025	14.469	13 113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	3.986	3.835	13.975	13.438
April	3.993	4.168	4.051	13.469	13.297
May	4.253	.....	.....	12.938	.....
June	4.466	.....	.....	12.600	.....
July	4.744	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York		St. Louis.		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	4.757	4.527	4.607	21.075	21.438
April	4.645	4.965	4.495	4.815	21.344	21.531
May	4.608	.....	4.458	.....	19.906	.....
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

Mining and Metallurgical Companies—U. S.

Name of Company and Location.		Shares. Issued.	Par Val.	Dividends. Total to Date.	Latest. Date.	Amt.
Alaska, Mexican, g..	Alas.....	180,000	$ 5	$ 2,184,381	April '09	$0.40
Alaska Treadwell, g.	Alas.....	200,000	25	10,485,000	April '09	0.50
Alaska United, g...	Alas.....	180,200	5	513,520	April '09	0.25
Amalgamated, c....	Mont.....	1,538,879	100	70,018,993	May '09	0.50
Am. Sm.&Ref., com.	U. S.....	500,000	100	16,000,000	April 09	1.00
Am. Sm. & Ref., pf.	U. S.....	500,000	100	30,625,000	April '09	1.75
Am. Smelters, pf. A.	U. S.....	170,000	100	3,965,000	June '09	1.50
Am. Smelters, pf B.	U. S.....	300,000	100	6,000,000	June '09	1.25
Am. Zinc, Lead&Sm.	Kan.....	80,000	25	280,000	Nov. '07	0.50
Anaconda, c.....	Mont.....	1,200,000	25	43,650,000	Jan. '09	0.50
Arizona, c.....	Ariz.....	3,682,520	....	6,182,520	April '06	0.50
Atlantic, c.....	Mich.....	100,000	25	990,000	Feb. '05	0.02
Bald Butte, g. s....	Mont.....	250,000	1	1,354,648	Oct. '07	0.04
Beck Tunnel, g. s. l.	Utah.....	1,000,000	0.10	675,000	Oct. '07	0.02
Bent'n M.&D.,pf.,l.z.	Wis.....	196,607	1	10,949	Nov. '08	0.01½
Boston & Montana..	Mont.....	150,000	25	53,400,000	April '09	3.00
Bull.Beck. & Cham.g	Utah.....	100,000	10	2,728,400	July '08	0.10
Bunker Hill & Sull..	Ida.....	300,000	10	10,971,000	May '09	0.15
Butte Coalition, c. s.	Mont....	1,000,000	15	2,450,000	Dec. '07	0.15
Calumet & Arizona,c.	Ariz.....	200,000	10	10,500,000	May '09	1.00
Calumet & Hecla, c..	Mich.....	100,000	25	108,950,000	June '09	6.00
Camp Bird, g., s....	Colo.....	820,000	5	5,904,000	May '09	0.24
Carisa, c. g.....	Utah.....	500,000	1	55,000	Nov. '06	0.01
Colorado, l. g. s....	Utah.....	1,000,000	0.20	1,390,000	April '09	0.08
Columbus Con., c....	Utah.....	283,.40	5	226,832	Oct. '07	0.20
Combi'tion Co. G'f'd.	Nev.....	320,000	1	688,000	Sept. '06	0.15
Con. Mercur, g.....	Utah.....	1,000,000	1	3,385,313	Dec. '06	0.02½
Continental, z. l....	Mo.....	22,000	25	231,000	Oct. '08	0.25
Copper Range Con..	Mich.....	384,185	100	8,067,885	April '09	1.00
Creede United, g...	Colo.....	1,625,000	1	214,053	July '06	0.00½
Daly Judge, g. s. l..	Utah.....	300,000	1	225,000	April '07	0.37½
Daly West, g. s. l...	Utah.....	180,000	20	5,731,000	April '09	0.30
De Lamar, g. s.....	Ida.....	80,000	5	835,200	Sept. '06	0.24
Doe Run, l.....	Mo.....	59,062	100	1,859,893	Mar. '09	1.50
Elkton Con., g.....	Colo.....	2,500,000	1	2,316,959	April '09	0.01½
El Paso, g.....	Colo.....	2,450,000	1	1,315,545	Sept. '08	0.01
Fed Sm., com.....	Idaho....	60,000	100	2,708,750	Jan. '09	1.50
Federal Sm., pf.....	Idaho....	120,000	100	4,751,250	June '09	1.75
Findley, g.....	Colo.....	250,000	1	337,500	Sept. '06	0.01
Florence, g.....	Nev.....	1,050,000	1	420,000	Nov. '08	0.10
Frances-Mohawk, g.	Nev.....	912,000	1	546,000	Jan. '08	0.05
Gemini-Keystone...	Utah.....	5,000	100	2,000,000	Aug. '07	10.00
Gold King Con.....	Colo.....	3,750,370	1	1,407,504	May '05	0.01
Goldfield Con., g....	Nev.....	3,532,371	10	1,770,428	April '09	0.30
Grand Central, g....	Utah.....	250,000	1	1,321,250	Dec. '07	0.04
Gwin Mine, Dev., g..	Cal.....	100,000	10	496,000	April '06	0.05
Hecla, s. l.....	Idaho....	1,000,000	0.25	1,690,000	Dec. '08	0.01½
Homestake, g.....	S. D.....	218,400	100	24,372,440	May '09	0.50
Horn Silver, g.s.c.z.l.	Utah.....	400,000	25	5,642,000	Sept. '07	0.05
Imperial, c.....	Ariz.....	500,000	10	300,000	June '07	0.20
Inter'l Nickel, pf...	N. Y.....	89,126	100	1,871,646	May '09	1.50
Iron Blossom, s. l...	Utah.....	1,000,000	0.10	80,000	April '09	0.08
Iron Silver.....	Colo.....	500,000	20	4,100,000	Oct. '07	0.10
Jamison, g.....	Cal.....	390,000	10	347,100	April '09	0.02
Jerry Johnson.....	Cal.....	1,500,000	1	86,700	Jan. '08	0.01
Kendall, g.....	Mont.....	500,000	5	1,275,000	Oct. '08	0.02
Liberty Bell, g. s...	Colo.....	130,551	5	130,440	Jan. '07	0.15
Lightner, g.....	Cal.....	102,255	1	253,081	Oct. '06	0.05
Lower Mammoth, g.	Utah.....	190,000	1	57,000	Sept. '07	0.07½
Mammoth, g. s. l...	Utah.....	400,000	2.50	2,220,000	Mar. '08	0.05
Mary McKinney, g..	Colo.....	1,309,252	1	841,093	Dec. '08	0.02
May Day, g. s. l....	Utah.....	800,000	1	108,000	Sept. '08	0.01½
Mohawk, W.....	Mich.....	100,000	25	1,850,000	Feb. '09	2.00
Mont. Ore Purch...	Mont.....	80,833	25	9,437,274	Jan '07	15.00
Nevada Hills, s.g....	Nev.....	746,000	5	373,000	Dec. '07	0.10
New Century, z. l...	Mo.....	300,000	1	213,000	Dec. '06	1.01
Newhouse M. & S. c.	Utah.....	600,000	10	300,000	Sept. '07	0.50
New Idria, q.....	Cal.....	100,000	5	1,080,000	Jan. '09	0.30
New Jersey Zinc....	U. S.....	100,000	100	12,000,000	May '08	4.00
North Butte.....	Mont.....	400,000	15	7,200,000	June '09	1.00
North Star, g.....	Cal.....	250,000	10	1,911,988	Mar. '09	0.50
Old Dominion, c....	Ariz.....	293,245	25	849,332	Mar. '09	1.00
Old Dominion,M&Sc	Ariz.....	162,000	25	526,500	Mar. '09	1.00
Ophir, g. s.....	Nev.....	201,600	3	1,816,360	May '08	0.10
Osceola, c.....	Mich.....	96,150	25	7,420,250	Jan. '09	2.00
Parrot, c. s.....	Mont.....	229,850	10	6,807,649	Sept. '07	0.25
Pennsylvania, g....	Cal.....	51,500	100	284,925	July '05	0.10
Phelps, Dodge & Co	U. S.....	44,934,600	1	1,123,365	April '09	0.02½
Portland, g.....	Colo.....	3,000,000	1	8,227,080	Jan. '09	0.40
Quartette, g. s.....	Nev.....	100,000	10	375,000	July '07	0.20
Quincy, c.....	Mich.....	110,000	25	18,560,000	Mar. '09	1.00
Sacramento, g. q...	Utah.....	1,000,000	1	225,000	Nov. '06	0.00½
St. Joseph, l.....	Mo.....	1,000,000	10	6,308,357	Mar. '09	0.15
Shannon, c.....	Ariz.....	300,000	10	450,000	July '07	0.50
Silver Hill, g. s....	Nev.....	108,000	1	81,000	June '07	0.05
Silver King, g. s. l.†	Utah.....	150,000	20	11,187,500	July '07	0.33½
Silver King Co't'n.†	Utah.....	1,224,425	5	1,105,402	April '09	0.15
Sioux Con.....	Utah.....	746.389	1	335,595	April '09	0.07
Snowstorm, s. l.....	Ida.....	1,500,000	1	735,000	May '09	0.03
Standard Con., g. s..	Cal.....	178,394	10	5,194,130	Dec. '08	0.10
Stratton's Independ.	Colo.....	1,000,000	5	4,895,865	April '06	0.12½
Swansea, g. s. l.....	Utah.....	100,000	5	329,500	Mar. '07	0.05
Tamarack, c.....	Mich.....	60,000	25	9,420,000	July '07	4.00
Tennessee, c.....	Tenn.....	200,000	25	2,056,250	Sept. '08	1.25
Tomboy, g. s.....	Colo.....	300,000	5	2,016,000	Dec. '08	48
Tonopah of Nev....	Nev.....	1,000,000	1	4,600,000	April '09	0.35
Tonopah Belmont..	Nev.....	1,500,000	1	600,000	April '07	0.10
Tonopah Ext'nsion	Nev.....	928,433	1	283,030	April '06	0.15
Tonopah Midway...	Nev.....	1,000,000	1	250,000	Jan. '07	0.05
Uncle Sam, g. s. l...	Utah.....	500,000	1	295,000	Dec. '08	0.02
United States, com.	Utah.....	350,933	50	2,148,099	April '09	0.50
United States, pfd.*.	Utah.....	485,845	50	5,306,495	April '09	0.87½
United Cop. com...	Mont.....	450,000	100	5,962,500	Aug. '07	1.75
United, c. pf.....	Mont.....	50,000	100	1,500,000	May '07	3.00
United, z. l., pf....	Mo.-Kan.	19,556	25	312,782	Jan. '08	0.50
United Verde, c....	Ariz.....	300,000	10	1,385,322	Mar. '09	0.75
U. S. Red. & Ref. Pf.	Colo.....	39,458	100	1,005,504	Oct. '07	1.50
Utah, g. (Fish Sp'gs)	Utah.....	100,000	10	323,000	Feb. '09	0.02
Utah Con., c.....	Utah.....	300,000	5	7,500,000	April '09	0.50
Utah Copper.....	Utah.....	725,950	10	1,451,900	June '09	0.50
Victoria, Utah.....	Utah.....	250,000	1	177,000	Mar. '07	0.04
Vindicator Con., g..	Colo.....	1,500,000	1	1,980,000	Jan. '09	0.03
Wolverine, c.....	Mich.....	60,000	25	5,400,000	April '09	5.00
Work, g.....	Colo.....	1,500,000	1	172,500	July '08	0.01
Yankee Con.....	Utah.....	1,000,000	1	182,500	Jan. '07	0.03
Yellow Aster, g....	Cal.....	100,000	10	958,789	Aug. '07	0.20

*Previous to consolidation $1,436,250 were divided. †Amalgamaetd.

Coal, Iron and Other Industrials—United States

Name of Company and Location.		Shares. Issued.	Par Val.	Dividends. Total to Date.	Latest. Date.	Amt.
Allis-Chalmers, pf...	U. S.....	161,500	100	$3,108,875	Feb. '04	$1.75
Amer. Ag. Chem., pf.	U. S.....	181,530	100	1,747,620	April '09	3.00
American Cement...	Pa.....	200,000	10	1,288,000	Jan. '09	0.30
American Coal.....	Md.....	50,000	25	2,555,000	Mar. '09	1.25
Bethlehem Steel, pf.	Pa.....	150,000	100	900,000	Nov. '06	0.75
Cambria Steel.....	Pa.....	900,000	50	9,450,000	Feb. '09	0.75
Central C. & C., com.	Mo.....	51,250	100	2,613,750	April '09	1.50
Central C. & C., pf...	Mo.....	18,750	100	1,476,562	April '09	1.25
Col.&Hock. C.&I.,pf.	Ohio.....	69,244	100	383,818	April '08	1.50
Consolidated Coal..	Ill.....	50,000	100	350,000	July '04	1.00
Consolidation Coal..	Md.....	102,500	100	x10 431,650	Jan. '09	3.50
Crucible Steel, pf...	Pa.....	244,365	100	8,430,593	Mar. '09	1.00
Empire S. & I., pf...	N. J.....	25,000	100	933,033	Jan. '09	1.50
Fairmont Coal.....	W. Va...	120,000	100	1,980,000	Jan. '09	2.00
Gen. Chem., com....	U. S.....	74,103	100	2,297,193	June '09	1.00
General Chem., pf..	U. S.....	100,000	100	6,255,000	Jan. '09	1.50
International Salt...	Penn.....	182,280	100	911,400	Dec. '06	1.00
Jeff.&Cl'f C.&I., cm.	Pa.....	15,000	100	330,000	Aug. '05	5.00
Jeff.& Cl'f C. & I., pf.	Pa.....	15,000	100	900,000	Feb. '09	2.50
Kern River Oil.....	Cal.....	20,000	100	84,000	July '08	0.10
Lehigh Coal & Nav..	Pa.....	382,260	50	15,779,410	May '09	2.00
Maryland Coal, pf..	Md.....	18,850	100	‡2,013,997	Dec. '08	2.50
Monon R. Coal, pf...	Pa.....	100,000	100	2,324,000	July '08	3.50
Nat. Carbon, com...	U. S.....	55,000	100	715,000	April '08	1.00
Nat. Carbon, pf....	U. S.....	45,000	100	3,071,250	Nov. '08	1.75
National Lead, com.	N. Y.....	149,054	100	3,456,497	July '09	1.25
National Lead, pf...	N. Y.....	149,040	100	18,155,068	Mar. '09	1.75
Nat'l Steel&Wire,pf.	N. Ye....	25,778	100	631,561	May '06	1.75
New Central Coal...	Md.....	50,000	20	390,000	Nov. '08	0.40
New River Coal, pf..	W. Va...	37,617	100	451,405	Nov. '08	1.50
Pacific Coast Borax.	Cal.....	19,000	100	2,086,500	Aug. '05	1.00
Peerless Oil.....	Cal.....	92,000	10	711,000	June '08	0.06
Penna. Salt.....	Pa.....	60,000	50	15,098,000	Oct. '08	3.00
Penna. Steel, pf.....	Pa.....	165,000	100	8,662,500	Nov. '08	3.50
Phila. Gas, com.....	Pa.....	664,800	50	*24,264,600	Feb. '09	0.75
Phila. Gas, pf.....	Pa.....	120,000	50	2,850,000	Sept. '08	1.25
Pittsburg Coal, pf...	Pa.....	297,010	100	11,434,962	April '09	1.75
PocadontasC.C., pf.†	W.&Va..	28,000	100	252,000	Jan. '09	3.00
Pocah'tasC.C., cm.†	W. Va...	45,000	100	†406,800	Oct. '08	3.00
Republic I.&S., pfd.	Ill.....	204,169	100	6,045,338	April '08	1.75
Sloss-Sheffield, com.	Ala.....	100,000	100	2,133,000	June '09	1.25
Sloss-Sheffield, pf...	Ala.....	67,000	100	4,221,000	Jan. '09	1.75
Standard Oil.....	U. S.....	970,000	100	652,802,905	June '09	9.00
Tenn. C. & I., com..	Tenn.....	225,536	100	3,583,060	Nov. '07	1.00
Tenn. C. & I., pf...	Tenn.....	2,480	100	390,040	Nov. '07	2.00
Texas & Facific Coal.	Texas....	23,940	100	1,747,620	April '09	1 50
Uni. Metals Selling..	U. S.....	50.000	100	5,875,000	Jan. '09	5.00
U.S. Steel Corp., cm.	U. S.....	5,083,025	100	83,848,056	Mar. '09	0.50
U. S. Steel Corp., pf.	U. S.....	3,602,811	100	231,585,110	Mar. '09	1.75
Va. Carolina Ch., pf.	U. S.....	180,000	100	14,700,869	April '09	2.00
Warwick I. & S.....	U. S.....	148,671	10	517,739	Nov.. '08	0.30
Westmoreland Coal..	Pa.....	60,000	50	8,880,000	Oct. '08	2.50

*Since 1894. †Since 1907. ‡Since 1890. xStock div. $6,130,000 Mar. '09

Canada, Mexico, Central and South America

Name of Company and Location.		Shares. Issued.	Par Val.	Dividends. Total to Date.	Latest. Date.	Amt.
Amistad y Conc'rdia	Mex.....	9,600	50	$417,070	April '08	$1.36
Batopilas.....	Mex.....	446,268	20	†55,784	Dec. '07	0.12½
British Columbia, c.	B. C.....	503,000	5	201,200	Sept. '07	0.40
Buffalo, s.....	Ont.....	900,000	1	399,000	May '09	0.01
Butters' Salvador, g.	Salv.....	150,000	5	600,000	April '05	0.25
Cobalt Central, s....	Ont.....	4,761,500	1	92,230	Feb. '09	0.02
Coniagas, s.....	Ont.....	800,000	5	720,000	July '08	0.15
Consolidated M. & S.	B. C.....	53,552	100	781,885	Nov. '07	1.25
Crow's Nest Pass....	B. C.....	160,000	25	2,018,648	July '07	0.62½
Crown Reserve, s...	Ont.....	1,750,000	1	612,500	Mar. '09	0.15
Dolores, g. s.....	Mex.....	400,000	5	660,000	Aug. '09	0.15
Dominion Coal, com.	N. S.....	150,000	100	3,150,000	Jan. '09	1.00
Dominion Coal, pf..	N. S.....	30,000	100	‡630,000	Feb. '08	3.51
Dos Estrellas, g. s...	Mex.....	300,000	0.50	3,780,000	Jan. '09	1.00
El Oro, g. s.....	Mex.....	1 080,000	5	4,989,600	July '08	0.36
Esperanza, s. g.....	Mex.....	455,000	5	9,390,400	Mar. '08	0.37
Foster Cobalt, s....	Ont.....	1,000,000	1	50,000	Jan. '07	0.05
Granby CWn.....	B. C.....	135,000	100	3,508,630	Dec. '08	2.00
Greene Con. Copper.	Mex.....	864,000	10	6,137,800	Mar. '07	0.40
Guanajuato.....	Mex.....	540,000	5	74,250	Oct. '06	0 07
Guanajuato D., pf. s.	Mex.....	10,000	100	30,000	July '08	3.00
Guggenheim Expl...	Mex.....	105,000	100	5,535,000	July '09	2.50
Hinds Con., g. s. c. l.	Mex.....	5,000,000	1	100,000	Feb. '08	0.02
Kerr Lake, s.....	Ont.....	600,000	5	1,108,000	June '09	0 30
La Rose Con., s....	Ont.....	1,143,368	5	628,252	April '09	0.20
Le Roi, Ltd., g.....	B. C.....	200,000	25	425,000	Dec. '06	0 48
Le Roi No. 2, g.....	B. C.....	120,000	25	889,200	Mar. '09	0 48
Lucky Tiger-Com., g.	Mex.....	65,000	10	71,500	Dec. '08	0.30
McKinley-Darragh, s	Ont.....	2,000,000	1	480,000	Jan. '09	0 05
Mex. Con. M.&S. Co.	Mex.....	240,000	10	660,000	Mar. '08	0 25
Mex. Mill.&Trans.pf.	Mex.....	12,000	100	35,450	Jan. '08	3 00
Mines Co. of Am....	Mex.....	2,000,000	1	3,605,000	Aug. '09	0.03
N. Y. & Hond. Ros..	C. A.....	150,000	10	2,497,000	May '09	0.10
Nipissing, s.....	Ont.....	1,200,000	5	2,640,000	April '09	0.25
N. S. St.&Coal, com.	N. S.....	9,876	100	1,087,856	April '08	1.50
N. S. St. & Coal, pf..	N. S.....	10,300	100	479,130	April '09	2.00
Penoles*.....	Mex.....	2.500	100	8,630,000	Dec. '07	20.00
Peregrina, pf. s.....	Mex.....	10,000	100	538,656	Mar. '09	3.50
Pinguico, pf. s.....	Mex.....	20,000	100	240,000	Oct. '08	3.00
Reco, g. s. l.....	B. C.....	985,000	1	527,082	April '06	0.02
Right of Way.....	Ont.....	499,518	1.00	264,701	May '09	0.10
Securities Corp., pf..	Mex.....	2,000	100	42,699	July '08	3.50
Silver Queen, s.....	Ont.....	1,500,000	1	345,000	Nov. '08	0.05
Temiskaming, s....	Ont.....	2,500,000	1	525,000	April '09	0.06
Tezuitlan Copper...	Mex.....	10,000	100	.....	Dec. '08	1.20
Tilt Cove, c.....	N. F.....	89,000	2	495,630	May '08	0.55
Tretheway, s.....	Ont.....	945,450	1	311,998	May '09	0.10
Tyee, c.....	B. C.....	180,000	5	201,600	Aug. '07	0.63

*Mexican Currency. †Since reorganization. ‡Since August, 1905.

Industrials

W. L. Imlay Rapid Cyanide Process Company, Philadelphia, Penn., reports having closed its first 100-ton daily plant with the Gold Ridge Mining Company of Alabama.

The Wood Drill Works, of Paterson, N. J., has a number of copies of an enlarged sectional cut of the "Wood" rock drill which they are distributing gratuitously among mining schools desirous of securing a copy.

Buckeye Engine Company, Salem, Ohio, announces the appointment of Louis Bendit, as Kansas City sales manager, with offices at 504 N. Y. Life building, and J. R. Detweiler, as district manager, 505 Barnes building, Wichita, Kan.

Among the recent orders received by Tate, Jones & Co., Inc., Pittsburg, Penn., is an extensive one from the Erie Forge Company, Erie, Penn., for fuel-oil burning equipment for use in open-hearth furnaces. Uniformity, low cost and a steady supply are given as the reasons for the installation of oil over other fuels.

The Wagner Electric Manufacturing Company has opened an office in Denver, Colo., located in the Ideal building. This new office is in charge of O. H. Davidson, of the Electric Manufacturers' Sales Company. Mr. Davidson will have charge of the Wagner Company's business in Colorado, New Mexico, Utah, Montana and eastern Idaho.

The Independent Pneumatic Tool Company, of Chicago, Ill., has recently appointed the Burnite Machinery Company, 1710 Glenarm street, Denver, Colo., exclusive Colorado agents for their well known line of Thor pneumatic tools. A full line will be carried in stock, including piston air drills (reversible and non-reversible); pneumatic reaming, tapping and flue rolling machines; pneumatic wood-boring machines, pneumatic riveting, chipping, calking and beading hammers; pneumatic grinding machines, saws and flue expanders, repair parts for all machines. All orders for Colorado and vicinity should be sent to the Denver office.

John L. Wagner, vice-president of the Pneumelectric Machine Company, Syracuse, N. Y., spoke before the mining engineers' department of the State College of Pennsylvania on Wednesday, March 24, on "Mining Coal with the Electric Puncher." His paper, which was illustrated by numerous lantern slides, presented briefly the history of the application of electricity to coal-mining machines and showed in detail the latest designs of the Pneumelectric coal puncher, which represents the only machine of the reciprocating percussive type directly operated by a motor forming a part of the machine, and the only type in which the air is both compressed and utilized within the same cylinder.

S. B. Stine reports having recently closed contracts for the following complete ventilating equipment: The Maderia Hill Coal Mining Company, one 10-ft. fan, with engine; Cabin Creek Consolidated Coal Company, Kayford, W. Va., one 4-ft. direct connected fan, with Westinghouse motor; one 8-ft. belted fan and one 6-ft. belted fan; the Turkey Gap Coal Company, Ennis, W. Va., one 6-ft. fan and engine; the Price Coal Company, Ethel, W. Va., one 7-ft. fan and engine; the Rex Coal Company, Ethel, W. Va., one 8-ft. fan; Leahey Coal Mining Company, Lilly, Penn., one 5-ft. fan and engine; the Lambert Run Coal Mining Company, Fairmont, W. Va., one 5-ft. fan and engine; the La Belle Coal Company, Wellsburg, W. Va., one 5-ft. fan. J. T. Beard, the Scranton expert, has taken charge of the fan department of S. B. Stine and will act as his consulting engineer.

The Jeffrey "Lock-Jaw" wrench is the simple practical, common-sense development of the demand for a wrench whose jaws would not spread. Every man familiar with the severe service of track work realizes clearly enough the constant drain of expense in taking care of this troublesome complaint. The expense of wrench repairs has grown up through the years close and tight to the great body of maintenance costs. It requires, therefore, the closest investigation from a new standpoint—with the aid of the Jeffrey "Lock-Jaw" as a prod and wedge—to show up clearly how this clinging growth can be wrenched loose. Once rid of such expense, the Jeffrey "Lock-Jaw" wrench will be constantly in service as a safeguard against all future expense for track wrench repairs. Any wrench which fails through spreading of its jaws will be replaced free of charge.

The Curtis rotary pump is a positive rotary pump, that is to say, it can be used on high heads as well as low heads. This pump was designed more especially for mine service, although it is adapted for any service where piston pumps can be used. They are usually made iron bronze-lined, but for acid-mine water are constructed of solid acid resisting bronze. The blades or buckets in revolving rotor are made of wood or an anti-friction composition. The bearings in the heads are made exceptionally long and are either high-grade babbitt or lignum vitae and are supplied with exceptionally large grease cups where grease can be forced down by application of wrench with heavy plungers. The pumps are made in all sizes from 50 g.p.m. to 2000 g.p.m. capacity The machine work on them is especially high grade. They are peculiarly adapted for mine service and take up very little room and are easily handled. The pumps are manufactured by the Pittsburg Machine Tool Company, N. S., Pittsburg, Penn.

Wm. Ainsworth & Sons, Denver, Colo., have just placed on the market a new theodolite for mountain and mining work. By the use of the hardest bronze alloys the weight of this instrument has been reduced to a minimum without sacrificing rigidity, and the U or theodolite standard, the merits of which are now well recognized, is so designed as to admit of placing a 2½-in. compass in the center, which is sufficient for checking. It has 4½-in. limb and vertical circle with edge graduation, 8-in. 20-power main telescope, 7-in. 18-power auxiliary telescope with counterweight that may be used either as a top or side telescope, 4-in. 30-sec. telescope level, stadia, gradienter, magnetic variation circle, 4-screw leveling head and extension tripod. The instrument weighs only 9 lb. complete with all attachments. The limb verniers are placed at 30 deg. with the line of sight, which together with the edge graduation on the vertical circle, enables an operator to read both vertical and horizontal angles from the one position. The telescope tubes are finished in an improved manner, insuring perfect collimation for all distances. Only the highest grade lenses ground according to the latest formulas are used. The telescope axis has the usual grooved bearings common to all this firm's instruments, the merits of which are now well recognized. The leveling head is of improved design and accurately constructed so that it cannot be cramped in any position, which greatly reduces the wear on the leveling screws and renders it unnecessary to loosen all of the screws when leveling up. The shifting center has a movement of ½ in. to permit locating plumb bob over point. The graduations, with the exception of the compass circle, are on solid silver and produced on their new 30-in. automatic dividing engine, which machine it is claimed is capable of producing automatically circles accurate to within one second of arc. The instrument is fully described in their catalog "BX."

The Bunker Hill screen, introduced by the Hendrie & Bolthoff Manufacturing Company, Denver, Colo., consists of an inverted truncated cone formed by stretching the screen cloth over a suitable wrought iron frame. This cone is attached to a hollow shaft set at an angle of 45 deg. and driven by bevel gearing and tight and loose belt pulleys. The hopper, also cone shaped, is fastened to the frame. It has near its bottom a discharge opening for the undersize, and carries a bracket which supports the feed box. The feed box is of sheet iron and contains a regulating shutter valve. The whole screen is mounted on a cast iron frame and is entirely self-contained. The screen is supplied with two spray pipes; one on the inside, adjustable by means of a universal joint and located on the side opposite to the feed box, and the other outside passing down nearly vertically between the screen and the hopper. The feed is deposited on the screen a little below the meridian line and falls in the same direction as the travel of the screen. The ore current may be thickened or thinned as occasions may require, by means of the shutter valve above referred to. The oversize is discharged through the hollow shaft and the undersize through the pipe tapped into the hopper surrounding the screen. The inner spray pipe washes through the screen any small particles that may not have passed through its meshes, while the outer spray pipe serves to keep the meshes open and prevents blinding. From the foregoing description it is readily seen that, on account of the conical shape of the screen, its peripheral speed is constantly varying in direct proportion to its different diameters at different sections. For this reason and also on account of the slight centrifugal force to which the particles to be screened are subject, they are forced to undergo a twisting motion, presenting all different faces to the wash water and the screening surface. The capacity of the Bunker Hill screen ranges from 25 to 50 tons per day and even more on certain ores. This is rather surprising, but not to those who have had occasion to know the screen from its inception, and have familiarized themselves with its working. Since the oversize is speedily washed away and discharged as soon as formed it does not occupy useful screening surface and block the way of the small grains. It is almost necessary to see the screen at work before one can realize its extraordinary capacity.

New Catalogs

Eastern Mfg. Co., Elmira, N. Y. Catalog. Elmira wood pipe. Illustrated, 68 pages, 6x9 inches, paper.

Eimer & Amend, 205 Third avenue. Catalog. Calorimeters and pyrometers. Illustrated, 44 pages, 6½x10 inches, paper.

Foote Mineral Company, 107 N. 19th street, Philadelphia, Penn. Catalog. Minerals. Illustrated, 320 pages, 6x9 inches. Leather and cloth bound.

Baldwin Locomotive Works, Philadelphia, Penn. Record No. 66. Smoke box superheater, feed water heater. Illustrated, 32 pages. 6x9 inches.

Western Electric Company, 463 West street, New York. Bulletin, "First Rateau Regenerator Installed in America," by F. G. Gaesche. 8x10½ inches.

Dean Bros. Steam Pump Works, Indianapolis, Ind. Catalog No. 77. Lists of parts of pumps, directions for operating pumps, etc Illustrated, 76 pages, 6x7 inches, paper.

J. Geo. Leyner Engineering Works Company, Littleton, Colo. Bulletin No. 1002. No. 5 Leyner stoper. Illustrated, 8 pages, 6x9 inches. Bulletin No. 1004. Efficient tunnel work. Illustrated, 8 pages, 6x9 inches.

International Steam Pump Company, 115 Broadway, New York. Bulletin W. 165. Worthington volute centrifugal pumps. Illustrated, 16 pages, 6x9 inches. Bulletin W 166. Triplex house tank pumps. Illustrated, 4 pages, 6x9 inches. Bulletin W 169. Boiler feed pumps. Illustrated, 4 pages, 6x9 inches.